

The Australian and New Zealand JOURNAL OF SURGERY

Vol. XXIV — No. 4

MAY, 1955

POSTERIOR MEDIASTINAL GOITRE

A REPORT OF ELEVEN CASES

By KENNETH N. MORRIS

Alfred Hospital, Melbourne

WHEN the thyroid gland enlarges in a downward direction it most commonly sends a mere tongue of tissue to lie behind the upper part of the sternum. Less commonly a large thyroid mass develops within the thorax and lies in the anterior mediastinum. These two forms of thyroid displacement together constitute the condition known as retrosternal goitre. Occasionally the thyroid gland may send an intrathoracic extension to lie in the posterior mediastinum. Such posterior mediastinal goitres possess special problems of diagnosis and treatment.

The essential anatomical differences between retrosternal goitre and posterior mediastinal goitre have been pointed out by Sweet (1949), who writes: "There is an important difference between the two types of goitre, depending upon their relations to the carotid sheath, the innominate veins, and on the right, the superior vena cava. Anteriorly placed substernal goitres always descend in front of these vessels. Posteriorly placed intra-thoracic goitres on the other hand, always descend behind them."

Keynes (1950), stated that he had only seen this condition twice, despite his extensive experience of thyroid surgery. In a review of the literature Tomkinson (1951) was only able to find 15 examples of posterior mediastinal goitre, and he described a further 3 cases. Since that time Wilson (1951) has published an account of 3, Hirschfeld (1951) two and MacMahon (1951) one. To date, the largest recorded series is that of Sweet

who gave details of 6 patients with this condition. The purpose of this paper is to place on record 11 cases of posterior mediastinal goitre seen at the Alfred Hospital.

These thyroid masses must be differentiated from other types of posterior mediastinal tumour, the commonest of which arise from nerve tissue. In 8 of the cases which will be detailed below, it was shown by radiological screening that the "tumour" moved with swallowing. This demonstrated that it moved with the trachea or oesophagus and made the diagnosis of "neurofibroma" untenable, but did not exclude tumours arising from these organs. In the other three cases this examination was not carried out. In 5 instances some enlargement of the thyroid gland could be detected in the neck, in 3 others there was the collar incision of a previous thyroidectomy.

Probably the only way in which a positive diagnosis could be reached would be by the use of radio-active iodine. After the administration of the iodine to the patient, its deposition in the thyroid mass could be demonstrated by the use of the appropriate apparatus.

The removal of these posterior mediastinal goitres is quite simple if the tumour is small. The cervical portion of the thyroid gland is removed in the standard manner through a collar incision and traction upon the intrathoracic extension results in its delivery into the neck.

When the tumour is large, its anatomical relationships have an important bearing upon the safety of the methods used to deliver it. Because of the size of the goitre it cannot be removed from the thorax by simple traction. Any attempt to assist the mass into the neck by stretching the surrounding structures is fraught with danger because of the large vessels which are in relation to its anterior aspect. If the intrathoracic extension has arisen from the left lobe of the thyroid gland, it will have the left innominate vein stretched tightly across it, just below the thoracic inlet. If it has arisen from the right lobe of the thyroid, the right innominate vein and the superior vena cava will be closely applied to it anteriorly.

The anterior aspect of the tumour is the only one which is accessible to the operator. If a finger or instrument is thrust through the thoracic inlet along the front of the mass, in an attempt to lift it into the neck, there is a grave danger of producing torrential haemorrhage from the innominate veins or vena cava.

It has been recommended and is generally accepted that large thyroid masses may be extracted from the thorax after their bulk has been reduced by piecemeal removal of the contents. This manoeuvre is particularly successful when portion of the intrathoracic mass is cystic. It must be remembered that the inferior thyroid veins are carried down into the thorax by the enlarging gland. It is not possible to secure these vessels before the tumour has been delivered. Even when the superior and inferior thyroid arteries have been ligated it is possible to get severe bleeding when attempts are made to pull fleshy pieces of thyroid tissue from the interior of the thoracic portion of the gland. This was our experience in Case 3.

Sweet (1949) recommends that these large posterior mediastinal goitres should be removed by transpleural thoracotomy, or by a combined operation comprising a cervical thyroidectomy plus thoracotomy.

There are two reasons why thoracotomy alone does not appear to be a logical procedure. The first is that it is not possible to do a complete operation by this means, any cervical enlargement of the thyroid must be left untouched. The second reason is that

the difficulties associated with the removal of these goitres, lie at the thoracic inlet. The vascular pedicle comes down from the neck, and when a large tumour is wedged in the thoracic inlet this pedicle is hidden from view and attempts to secure it are hazardous.

These difficulties can be overcome by a combined thoracotomy and cervical operation, but the problem can be solved much more simply by adding a sternum splitting incision to the standard cervical operation. When the sternum has been split and retracted widely, the whole operation field is under vision. The cervical stage of the operation has already resulted in the mobilization of that thyroid lobe from which the mass has arisen. The pedicle which connects the cervical and thoracic portions of the thyroid can be traced down to the apex of the posterior mediastinal goitre, protruding above the innominate vein which is tightly stretched across its anterior surface. It is now a simple matter to displace the great vessels carefully and deliver the goitre on to the surface. The whole procedure is deliberate, nothing is done blindly. Even if some mishap were to occur, the whole operation field is under direct control.

Case 1

Mrs. R.S., aged 43 years, had had a thyroidectomy performed seven years previously. Following this operation she had been well for about three years after which time she developed a persistent harsh cough. She had a number of attacks of bronchitis and bronchopneumonia.

X-ray showed that there was a mass in the posterior mediastinum. It projected to the right of the midline and extended downwards below the level of the arch of the aorta. The trachea was displaced forwards by the mass which lay behind it. No attempt was made to show by radiological screening whether or not the mass moved with swallowing.

Operation (10th July, 1946). The collar incision in the neck was reopened. The cervical muscles were retracted laterally and dissection was carried downwards towards the thoracic inlet on the right-hand side. The upper pole of the intrathoracic mass was seen to be projecting into the neck. Traction on the upper pole resulted in the delivery of the mediastinal goitre without any difficulty.

Case 2

Mr. E.M., aged 71 years, had had shortness of breath, wheeze and a brassy cough for several years. His chest was X-rayed following an attack of pneumonia. This showed that there was a mass in the posterior mediastinum displacing the trachea forwards and to the right. The mass itself protruded to the right of the midline.

Operation (21st October, 1947). A right-sided thoracotomy was performed. It was seen that a mass of thyroid tissue was bulging into the right pleural cavity from behind the superior vena cava. By palpation it was determined that there was a stout pedicle passing between the trachea and oesophagus upwards to the left side of the neck. It was decided that the pedicle could not be secured safely by this route. The chest was closed and the patient was turned on to his back. A collar incision was made in the neck, and the left lobe of the thyroid gland was mobilized in the standard manner. Traction upon the mobilized thyroid lobe resulted in the delivery of the mediastinal mass without resort to a sternum splitting extension of the exposure. It will be noted that in this case the intrathoracic extension of the thyroid gland originated from the left lobe, and grew downwards and across the midline so that its main mass was in the right chest.

Case 3

Mrs. H.S., aged 43 years, presented herself for X-ray in a microfilm survey and a mass was discovered in her upper mediastinum. Up until this time she had regarded herself as symptomless, but on questioning it was apparent that for the past two to three years there had been a slight but progressive decrease in exercise tolerance.

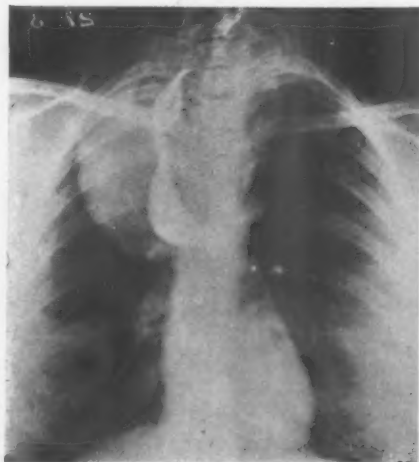


FIG. I. Case No. 3. P.A. view showing thyroid mass protruding into the right chest. Note displacement of trachea and oesophagus to the right, i.e., towards the tumour, not away from it.

On examination the patient was a healthy looking middle-aged woman with a moderately enlarged thyroid gland. When her attention was drawn to this enlargement, she said that her neck had had that appearance for at least twelve years, but that she had not regarded it as significant. There was some dullness to percussion in the upper part of the right thorax, and some diminution of air entry over the same area. Blood pressure 128/82 mm. of mercury, pulse 80 with regular rhythm.

X-ray showed a mass as illustrated in Fig. I and Fig II occupying the medial part of the right upper lung fields. The barium in the oesophagus showed that there had been displacement of the oesophagus forwards and to the right, i.e. towards the main bulk of the mass—not away from it. The trachea had been displaced in a similar manner. X-ray screening showed that the mass moved with swallowing. When a mass such as a thyroid enlargement displaces the trachea and oesophagus, it is usual that these organs are pushed away from the main bulk of the tumour. In this instance the reverse state of affairs existed. It was felt that this could only be explained by postulating that this right-sided tumour had originated in the left side of the neck, and in passing behind the oesophagus and trachea had firstly pushed them ahead to the full limit of their mobility, and had then continued to grow beyond them into the right hemithorax. At operation it was shown that this postulate was correct.

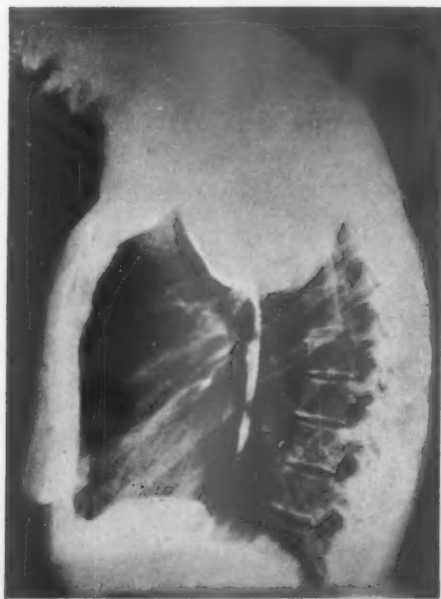


FIG. II. Case No. 3. Lateral view showing anterior displacement of the trachea and oesophagus.

Operation (28th March, 1950). A standard collar incision for thyroidectomy was made in the neck, and the necessary dissection made to explore the left lobe of the thyroid gland. This lobe was found to be enlarged, and from the posterior parts of its lower pole there was an extension into the thorax. The middle thyroid vein and the superior thyroid vessels were ligated and divided. The greater part of the left lobe of the thyroid was then freed so that it remained attached only at the lower pole. As the intrathoracic extension was much too large to be delivered through the thoracic inlet, an attempt was

made to eviscerate the thoracic mass. This produced considerable haemorrhage and the procedure was abandoned. The sternum was then split down the midline as far as the second intercostal space, and then divided transversely. The divided portions of the sternum were retracted laterally. This gave excellent exposure of the structures in the upper mediastinum and it was quite easy to deliver the thyroid mass from behind the left innominate vein. When this had been done the inferior thyroid veins were secured and the mobilized portion of thyroid was then completely free. A well defined cavity remained in the posterior mediastinum and a steady ooze of blood issued from its depths. This could only be controlled by packing the cavity with gauze, the end of which was brought out through the wound. The sternum was repaired with wire, and the wound closed around a rubber dam drain.

On the day following operation the patient had auricular fibrillation for twenty-four hours. A right-sided pneumothorax required air aspiration. The gauze pack was removed on the second day and she made an uneventful recovery.



FIG. III. Case No. 4. P.A. view showing the thyroid mass displacing the trachea and oesophagus to the right.

Case 4

Mrs. A.K., aged 53 years, had had a subtotal thyroidectomy performed twelve years previously. Four years prior to presenting upon this occasion, she had developed increasing dyspnoea with a

marked wheeze. She had been treated as an asthmatic over this period. Two weeks prior to her admission to the Alfred Hospital she had caught a cold. This accentuated her symptoms to an alarming degree.

Examination showed her to be a deeply cyanosed woman in great respiratory distress with inspiratory and expiratory stridor. Whenever she tried to drop off to sleep her airway became completely obstructed and she had to awaken to continue her laboured respiration. She had been unable to sleep for several days and was completely exhausted. The scar of her previous thyroidectomy could be seen in the neck, but no thyroid tissue could be palpated. There were distended veins over the upper chest.

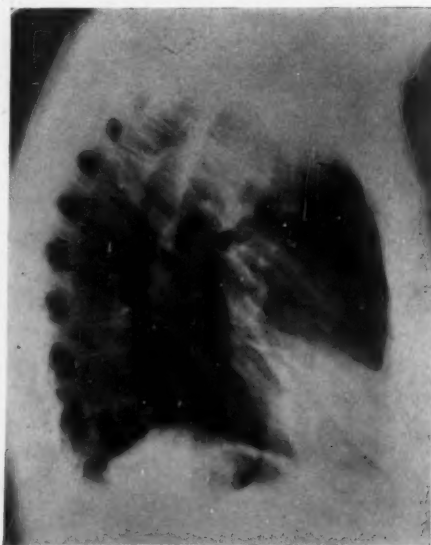


FIG. IV. Case No. 4. Lateral view showing extreme anterior displacement of the trachea.

X-ray showed that there was a mass in the posterior mediastinum causing gross displacement of the trachea, forwards and to the right (Fig. III and Fig. IV). This mass moved with swallowing. The oesophagus lay behind the tumour.

Operation (20th January, 1951). Anaesthesia was administered by Dr. R. Orton who passed an endotracheal catheter under local anaesthesia with the patient in the upright position. This established a clear airway and gave such relief that she immediately fell soundly asleep before any general anaesthetic drugs had been administered. General anaesthesia was maintained with pentothal, nitrous oxide and tubarine.

A vertical incision was made in the midline from the level of the thyroid cartilage to the level of the 3rd intercostal space. In the neck dissection was

carried down to the depth of the trachea which was greatly deviated to the right. During this dissection many grossly dilated veins were ligated. They caused a great deal of troublesome oozing. Some thyroid tissue could be felt on the right side of the neck, but on the left side none could be palpated. The sternum was split in the midline down to the level of the 3rd intercostal space where it was cut transversely, and the two portions were retracted laterally to expose the upper mediastinum. The upper portion of the intrathoracic goitre could be seen poking above the left innominate vein which was stretched tightly over its anterior aspect. By finger dissection the mass was delivered into the more superficial part of the wound and it could be seen that it had been lying between the oesophagus posteriorly and the trachea which had been stretched over its anterior aspect and pushed somewhat to the right. It was then found that there was quite a marked extension of the mass up into the neck which had not been palpable in the neck because it was behind the trachea. This was removed. The mass of thyroid tissue consisted of the main portion about the size of a tennis ball which had been in the chest, and a smaller mass about 1½" long and about 1" in diameter which had been behind the cervical trachea. A small hole in the left pleura was discovered, and this was closed with a linen stitch. The sternum was repaired with wire, a small rubber tube was placed behind the sternum for drainage. All superficial tissues were closed with fine catgut and the skin was closed with linen. The drainage tube was connected to a water seal bottle. The patient made a rapid recovery from the operation and was completely relieved of her symptoms.

Case 5

Mrs. H.W., aged 56 years, was shown by routine radiography to have a posterior mediastinal tumour. She declared herself very well apart from some weakness of her voice.

Physical examination showed her to be an obese middle-aged woman. The right lobe of the thyroid gland was enlarged.

X-ray showed that the tumour was displacing the trachea forwards and the oesophagus backwards. It was shown by screening that the mass moved with swallowing.

Operation (30th April, 1951). A collar incision was made in the neck and a vertical midline incision carried down from it over the sternum. The sternum was divided vertically to the second intercostal space and then laterally at his level. The divided edges of the sternum were retracted laterally. The thoracic portion of the thyroid gland was delivered from behind the left innominate vein and then followed up into the neck where its pedicle joined the left lobe of the cervical thyroid. The left lobe of the thyroid was removed in the standard manner. The edges of the sternum were approximated and the wound was closed.

The patient made an uneventful recovery but it was evident that the left recurrent laryngeal nerve had been damaged.

Case 6

Mrs. R.G., aged 36 years, stated that a thyroidectomy had been attempted ten years previously in Egypt, but it had been abandoned because she had collapsed at an early stage of the operation. She had no symptoms suggestive of thyrotoxicosis.

The only physical features of note were the scar of a previous collar incision overlying a smoothly enlarged thyroid gland.



FIG. V. Case No. 6. P.A. view showing the posterior mediastinal goitre displacing the trachea and oesophagus to the left.

X-ray showed a rounded mass in the posterior mediastinum. The trachea was displaced forward and to the left (Fig. V and Fig. VI). Screening showed that the mass moved with swallowing.

Operation (17th June, 1952). The cervical and thoracic thyroid masses were removed by the combined cervical and sternum splitting methods. During the dissection necessary to free the left innominate vein from the anterior aspect of the thoracic mass a small hole was torn in the vein. This would have been disastrous had it occurred as the result of blind manipulation behind the unsplit sternum. In this instance it was very easy to suture the damaged vein.

The immediate post-operative convalescence was complicated by a right pneumothorax. This was controlled by an intercostal catheter connected to a water seal drainage bottle. The patient's condition appeared to be satisfactory on the fifth day when she suddenly collapsed and died. Autopsy showed that death was due to a pulmonary embolus which had originated in the right femoral vein.



FIG. VI. Case No. 6. Lateral view showing anterior displacement of the trachea.

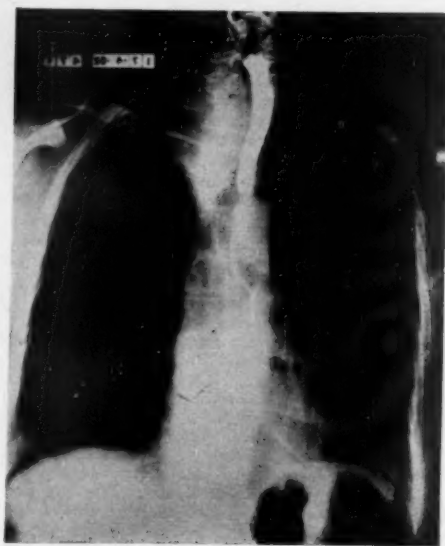


FIG. VII. Case No. 7. P.A. view showing the thyroid mass in the posterior mediastinum displacing the trachea and oesophagus to the left.

Case 7

Mrs. M.H., aged 58 years, had been treated for pulmonary tuberculosis twelve years previously. This had become quiescent. For the past five years she had noticed increasing shortness of breath upon exertion. Her thyroid gland was enlarged and nodular, particularly on the right side. There were a number of large blood vessels over the neck and upper chest.

X-ray showed a mass in the posterior mediastinum displacing the trachea and oesophagus to the left (Fig. VII). Screening showed that the mass moved with swallowing.

Operation (16th June, 1952). A collar incision was made in the neck. The right lobe of the thyroid gland was removed in the standard manner. A vertical incision was then made from the centre of the collar incision downwards over the sternum. The sternum was split to the second intercostal space and retracted laterally. The left lobe of the thyroid gland was mobilized except for its lower pole which was continuous, with the mass in the thorax. The thoracic goitre was delivered from behind the left innominate vein and the inferior thyroid veins were secured. The sternum and wound were repaired.

The convalescence of this patient was marred by the development of some infection in the vertical part of her incision. Before healing occurred it was necessary to remove the wires used to approximate the edges of the sternum. Since this time we have abandoned the use of wire for sternal repair. No. 2 chromic catgut is quite strong enough and seems to give less trouble.

Case 8.

Mrs. L.O., aged 83 years, complained that she had had a marked wheeze with increasing dyspnoea for over twenty years. It was getting much worse lately.

Examination of the neck showed that both lobes and the isthmus of the thyroid were enlarged. X-ray showed a large mass in the posterior mediastinum displacing the oesophagus and trachea forwards and to the right (Fig. VIII and Fig. IX). Screening showed that the mass moved with swallowing.

On 16th October, 1952, the patient became extremely dyspnoeic with almost complete respiratory obstruction, gross cyanosis and unconsciousness. Fortunately skilled aid was immediately available and Dr. R. Orton was able to pass an endotracheal catheter beyond the obstruction. The patient was then transferred to the operating theatre.

Operation. A vertical incision was made from the level of the thyroid cartilage to about the level of the 3rd costal cartilage. This was deepened to expose the thyroid gland above, and the sternum below. The sternum was split in the midline down to the 2nd intercostal space, and here cut laterally. The edges of the sternum were lifted and the pleura brushed away from the under surface, and the sides retracted. It could be seen that there was a large thyroid adenoma in the neck on the left side, and that this lobe of the thyroid was enlarged and extended down to thoracic inlet where it plunged posteriorly. Some dissection in the anterior mediastinum showed that the left innominate vein was lying anterior to the thoracic portion of the thyroid,

and that there was also a very large artery in this position. This artery was running in a horizontal direction and was probably the innominate artery displaced by the mass of the tumour. It was not possible to deliver the intrathoracic thyroid as it was tightly jammed anteriorly by these vessels. The trachea and oesophagus were lying in front of the thoracic mass, and it was apparent that before the sternum had been split, the trachea had been jammed against the back of the upper edge of the sternum by the thoracic thyroid. The isthmus of the thyroid was divided and the left lobe turned laterally. The upper pole of the left lobe was then dissected free and the superior thyroid vessel secured. The middle thyroid vein was ligated. It was then possible to work around the neck of the tumour and about 8-10 inferior thyroid veins, which were going to the left innominate vein were secured and ligated. After these had been divided, it was possible by gentle manipulation to deliver the tumour out of the chest. It was then found to be secured only by the inferior thyroid artery running into its posterior aspect. This was secured and divided, and the tumour removed. At no stage was the left recurrent nerve seen. It was found that the cavity in which the tumour had been lying extended downward to the level of the arch of the aorta, and to the right behind the oesophagus and trachea. The large vessels previously mentioned lay anteriorly. A piece of corrugated rubber dam was placed within the cavity and brought out through the neck. The sternal edges were brought together and held with a double thickness of No. 2 chromic catgut passed around the sternum and ribs. The soft tissues were then closed. The pleura was not opened at any stage.

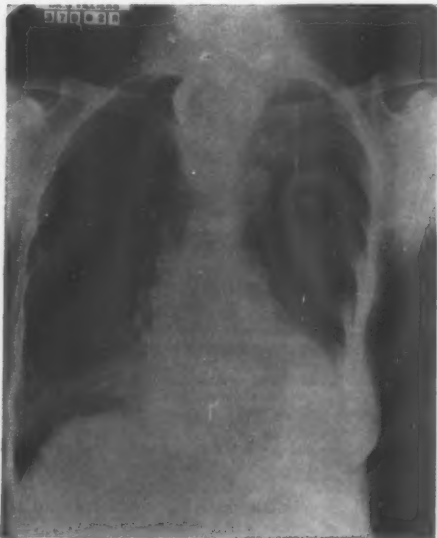


FIG. VIII. Case No. 8. P.A. view showing the thyroid mass in the posterior mediastinum displacing the oesophagus to the right.

The patient made a smooth post-operative recovery and was completely relieved of her symptoms.



FIG. IX. Case No. 8. Lateral view showing anterior displacement of the trachea and oesophagus.

Case 9

Mrs. M.T., aged 55 years, had had a thyroidectomy three years previously. For the past twelve months she had noticed a constricting feeling in the neck more marked when lying down. She had some difficulty with swallowing. Her voice was hoarse and occasionally failed altogether. No examination of the vocal cords was made prior to operation.

Physical examination did not reveal anything significant apart from the scar of the previous collar incision in the neck.

X-ray showed a small tumour in the posterior mediastinum (Fig. X). The trachea was displaced forwards and to the left. On screening it was seen that the mass moved with swallowing.

Operation (11th September, 1953). The old collar incision was reopened. There was a remnant of the right lobe of the thyroid still present. This was mobilized and traction upon it delivered the thoracic mass into the neck. It was not necessary to split the sternum. During the course of the operation the right recurrent laryngeal nerve could be seen very clearly running lateral to the cervical portion of the thyroid gland. Special note was made of the fact that this nerve was undamaged at the end of the operation.

The convalescence was uneventful. Examination of the vocal cords during the post-operative period showed that the right cord was paralysed. The patient's voice was the same in the post-operative period as it had been before operation, and it is felt that the damage to the nerve occurred at the time of the operation three years previously.

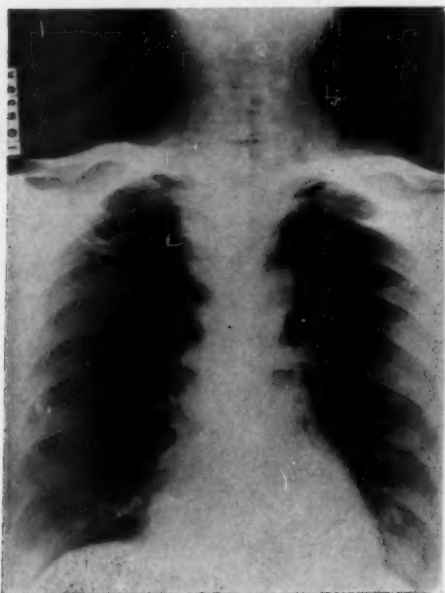


FIG. X. Case No. 9. P.A. view showing small thyroid mass in posterior mediastinum.

Case 10

Mrs. A.B., aged 53 years, had had an attack of pneumonia three years previously. For the past few months she had repeated attacks of "colds on the chest."

Physical examination did not reveal any significant abnormality.

X-ray showed a rounded mass about five inches in diameter in the upper part of the chest on the right side (Fig. XI and Fig. XII). No attempt was made to determine whether or not the mass moved with swallowing. -

The condition was diagnosed as a neurofibroma.

Operation (3rd March, 1953). A right thoracotomy was performed through the bed of the fifth rib. The tumour was seen to be protruding into the right thoracic cavity from behind the right innominate vein, and the inferior vena cava. The phrenic nerve was stretched across the anterior aspect and the vagus nerve was stretched over its antero-lateral

aspect. The pleura over the mass was incised and the vagus nerve was dissected forwards with the anterior pleural flap. The tumour was very easily stripped out of its pleural coverings. It was then realized that the condition was a posterior mediastinal goitre and that there was a pedicle of thyroid tissue going up through the thoracic inlet into the neck. The decision was made to complete the removal of the tumour by transection of the pedicle without resorting to a cervical incision. The pedicle was hidden from view by the bulk of the tumour. A lung tourniquet was placed so that its cord compressed the pedicle and maintained haemostasis while the fleshy interior of the thyroid mass was turned out. This manoeuvre made it possible to see the pedicle. A series of mattress sutures were placed through the pedicle just distal to the tourniquet, and then the tourniquet was removed. Very free bleeding occurred and a number of additional sutures were placed to control this. The remnants of the tumour were then cut away. The vagus nerve was examined closely and followed up to its recurrent laryngeal branch. It could then be seen that this nerve had been included in one of the sutures which had been placed in some haste after the tourniquet was released. This suture was removed to free the recurrent laryngeal nerve.

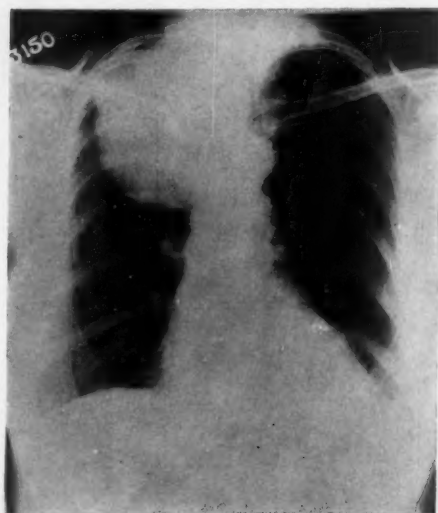


FIG. XI. Case No. 10. P.A. view showing large posterior mediastinal goitre protruding into the right thoracic cavity.

The mediastinal pleura was repaired and the chest closed.

In the post-operative period it was noted that the patient had a hoarse voice.

This operation demonstrates clearly the hazards of attempting to remove posterior mediastinal goitres by a purely thoracic approach. Considerable difficulty

was experienced in controlling the vascular pedicle. Had the pedicle slipped back into the neck out of the operative field it could have been disastrous. As it was, the recurrent laryngeal nerve was damaged during the efforts to produce haemostasis.

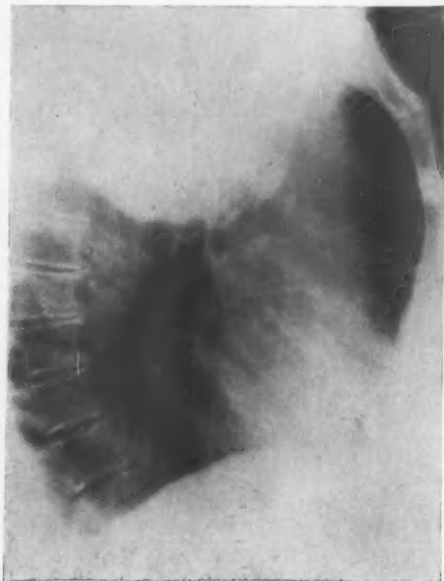


FIG. XII. Case No. 10. Lateral view showing large thyroid mass behind the trachea.

Case 11

Mr. W.P., aged 76 years, had suffered from substernal discomfort and indigestion for many years. His symptoms were relieved by a bland diet and alkaline powders. During the course of the radiological investigation of the cause of his indigestion it was noted that there was a mass in the upper mediastinum. There were no symptoms referable to this mass, and when questioned the patient stated that he had been told of this abnormality three years previously when it had been detected in a mass radiography survey. Physical examination was essentially negative. X-ray (Fig. XIII and Fig. XIV) showed a mass in the posterior mediastinum bulging into the right pleural cavity and displacing the trachea forwards. There are areas of calcification throughout the tumour. Screening showed that it moved with swallowing.

It was felt that in view of the patient's age and rather feeble general health it was wiser to avoid operation. It may happen that at some later date operation will become necessary because of the development of tracheal obstruction.



FIG. XIII. Case No. 11. P.A. view showing thyroid mass on the posterior mediastinum.

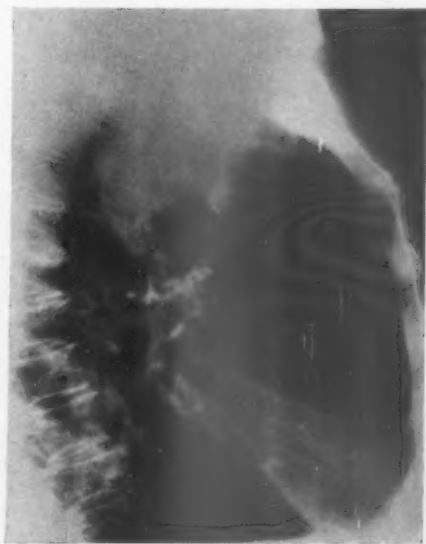


FIG. XIV. Case No. 11. Lateral view showing thyroid mass displacing the trachea forwards. Note the areas of calcification within the mass. The calcified ring in front of the trachea is the arch of the aorta.

SUMMARY

Eleven cases of posterior mediastinal goitre are described. In all those cases in which the examination was made, radiological screening demonstrated that the tumour moved when the patient swallowed. It is recommended that these tumours be removed by the cervical route when they are small, and by a combined cervical and sternum splitting approach when they are large.

ACKNOWLEDGEMENTS

I wish to thank Mr. C. J. Officer Brown for permission to publish Cases 1, 2, 3, 5, 9, 10.

Mr. C. A. M. Renou referred Cases 6, 7, 8. Mr. G. Grove referred Case 4. Case 11 was referred by Mr. I. Ogilvie.

REFERENCES

- HIRSCHFELD, K. (1951), *Aust. N.Z.J. Surg.*, vol. 21, page 81.
KEYNES, G. (1950), *Brit. Med. J.*, vol. 1, page 621.
MACMAHON, J. S. (1951), *Aust. N.Z.J. Surg.*, vol. 21, page 110.
SWEET, R. H. (1949), *Surg. Gynec. Obstet.*, vol. 89, page 57.
TOMKINSON, J. S. (1951), *Brit. J. Surg.*, vol. 38, page 271.
WILSON, E. (1951), *Brit. J. Surg.*, vol. 39, page 121.

CANCER OF THE BREAST IN SYDNEY TEACHING HOSPITALS

THE ROYAL PRINCE ALFRED HOSPITAL: W. J. PULLEN AND J. W. SPENCE

THE SYDNEY HOSPITAL: ALAN SHARP

ST. VINCENT'S HOSPITAL: J. P. FLEMING

THE ROYAL NORTH SHORE HOSPITAL: V. H. CUMBERLAND

*Diseases desperate grown by desperate appliances are
relieved, or not at all.*

(Hamlet, Act IV, Scene III)

THE main purpose of this paper is to discuss factors which may influence the 5 and 10 year survival rate and to report the results of treatment of 1,432 patients, 12 of whom were males, suffering from cancer of the breast. These patients were admitted as in-patients to the four teaching hospitals of Sydney during the years 1936-1948 inclusive. The hospitals concerned are the Royal Prince Alfred Hospital, the Sydney Hospital, St. Vincent's Hospital and the Royal North Shore Hospital.

Lancaster (1951) has shown that carcinoma of the breast accounts for 20 per cent. of all cancer in women in Australia. He has also shown that a little more than 2 per cent. of all females will die of cancer of the breast. Thus a review of this disease in the teaching hospitals of Sydney is opportune.

This survey embraces one third of all women who have suffered from cancer of the breast in New South Wales during the years 1936-1948 inclusive (official statistics).

The results listed here are not encouraging and it is felt that as far as this series is concerned there can be little cause for satisfaction or complacency in the treatment of breast cancers.

Method of enquiry

An examination was made of the histories of all patients with particular reference to name, age, length of history, site and size of lump, clinical staging, pathological staging, treatment and follow-up. It was not possible for any one person to peruse all the histories. However, the standards used in each hospital were similar and frequent consultations be-

tween members of the survey team eliminated any lack of uniformity in the appraisal of the clinical records. Where possible, surviving patients were interviewed and every endeavour was made to trace all patients included in the series. Of the total number, 173 patients (12 per cent.) were untraced. These untraced patients have been excluded, leaving 1,259 traced patients. Of these, two-thirds are dead from cancer or intercurrent disease. The intercurrent deaths are included as deaths due to cancer. This is in accordance with current practice.

The series has been divided into 3 groups:

1. From 1936-1940 inclusive which represents the pre-war period.
2. From 1941-1944 inclusive which represents the war period when upheavals might have been expected to have occurred in surgical units.
3. From 1945-1948 inclusive when it might be anticipated that radiotherapeutic equipment and techniques were of a higher standard and that the introduction of antibiotics and improved methods of resuscitation would contribute to an improved operative mortality.

The principal aim has been to determine any factors which might influence the 5 and 10 years survival rates. These survival rates were compiled up to October, 1953, so that in all groups the 5 year survival rate could be obtained. It was only possible of course to estimate the 10 year survival in groups 1 and 2, that is those patients who were treated from 1936 to 1943.

The system of staging which was used follows that adopted by Harnett (1952).

- Stage 1: Growth confined to breast; no involvement of axillary lymph nodes nor infiltration of skin or muscles.
- Stage 2: Growth confined to breast; axillary lymph nodes involved but no infiltration of skin or muscles.
- Stage 3: Growth infiltrating skin or muscle or both with or without involvement of axillary lymph nodes.
- Stage 4: Remote metastases present (cases of involvement of the supra-clavicular lymph nodes were placed in this stage).

No case was considered to be Stage 1 or 2 unless proven pathologically. For this reason it was unfortunately not possible to include a number of patients who were clinically Stage 1 or Stage 2 and who had apparently been successfully treated by radiotherapy alone, but for whom there had been no pathological confirmation of the diagnosis. It would seem that a biopsy should be taken in these cases if a reliable estimation of the results of treatment by radiotherapy alone is to be made. Stage 3 and Stage 4 growths were often of necessity staged on clinical grounds alone.

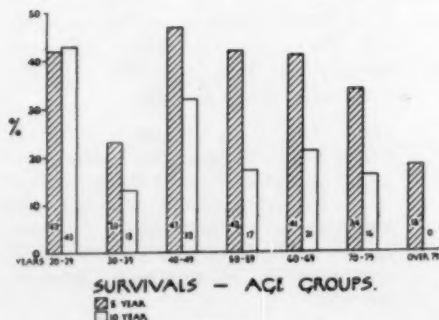


FIG. I

Factors which may influence 5 and 10 year survival rate

(A) Age

Analysis of the age groups in relation to 5 and 10 year survival (Fig. I) tends to indicate that the younger the patient, the greater

the expectation of life following treatment. There appears to be no suggestion that the prognosis following treatment is less favourable in the young. From 20-70 years the 5 year survival rate remains almost unchanged. The 10 year survival rate favours the younger patient.

(B) Length of history

Early diagnosis has always been considered an important factor in improving the results of treatment of this disease. In this series both the 5 and 10 year survival rates were much the same whether the patient reported within the first month or the fourth to sixth month after first becoming aware of a lump in the breast (Fig. II). Indeed, the survival rate is not strikingly different between those patients who reported within one month of noticing the presence of the lump and those who reported after two years. From this survey it is also apparent that despite propaganda, patients were not coming to treatment any earlier in 1948 than they were in 1936. In all, 14 per cent. of patients reported within the first month, 41 per cent. within the first three months, 60 per cent. within the first six months and 78 per cent. within the first year. In 8 per cent. the patients had known of the lump in their breasts for longer than two years.

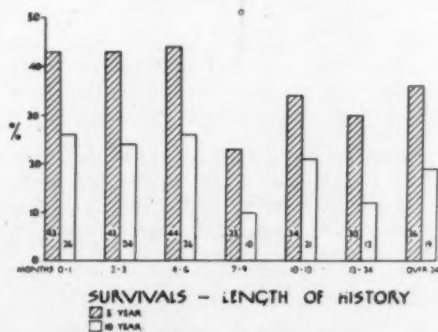


FIG. II

(C) Site of growth

The left breast was the site of growth more frequently than the right. In 1,312 cases, the left breast was involved 717 times (54 per

cent.) and the right 595 times (46 per cent.). This confirms the observation made in all the large series reported from overseas.

The position of the growth within the breast is shown in Fig. III. The upper and outer quadrant was by far the most common site.

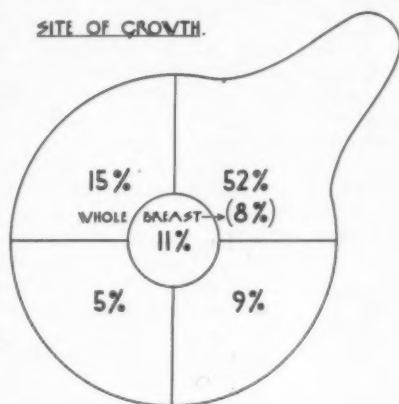


FIG. III

The following is an analysis obtained from one hospital and represents the 5 and 10 year survival rates of proven Stage 1 and Stage 2 growths in relation to the affected site in the breast in those patients who were submitted to radical mastectomy.

1. Outer half of breast
(133/275) 48 per cent. survived 5 years.
(43/168) 26 per cent. survived 10 years.
2. Inner half of breast
(31/71) 44 per cent. survived 5 years.
(9/36) 25 per cent. survived 10 years.
3. Central position
(17/34) 50 per cent. survived 5 years.
(5/19) 26 per cent. survived 10 years.

It is apparent that the site of the growth within the breast did not materially influence the survival rate in a series of 380 cases.

(D) Pathology

In 1,014 patients where an histological diagnosis was available, scirrhus growths

account for 73 per cent., intraduct 9 per cent., encephaloid 8 per cent., adenocarcinoma 7 per cent., mucoid 2 per cent., squamous cell carcinoma 0.4 per cent., sarcoma 0.3 per cent. and carcinoma with pregnancy or lactation 0.3 per cent.

The influence of the type of growth on the survival rate is illustrated by the following table which represents an analysis from two hospitals (614 patients).

Scirrhus

(175/445) 40 per cent. survived 5 years.
(57/256) 20 per cent. survived 10 years.

Encephaloid

(21/48) 44 per cent. survived 5 years
(6/33) 18 per cent. survived 10 years.

Adenocarcinoma

(38/48) 79 per cent. survived 5 years.
(18/31) 58 per cent. survived 10 years.

Mucoid

(9/14) 64 per cent. survived 5 years.
(5/10) 50 per cent. survived 10 years.

Intraduct

(40/59) 68 per cent. survived 5 years.
(12/33) 36 per cent. survived 10 years.

It can be seen that the scirrhus and encephaloid varieties were the most malignant and it is interesting to note that the more cellular and encephaloid lesion had a 5 year survival rate slightly higher than the scirrhus type.

(E) Age incidence of pathological types

The age incidence in 5 year periods of the various pathological types of breast cancer is shown in Fig. IV. The peak of incidence for scirrhus and encephaloid growths occurred in the 50-54 year period whereas Paget's disease of the nipple and intraduct carcinoma occurred some 5 to 10 years earlier. The incidence of adenocarcinoma rose irregularly to its highest level at the 60-64 year period.

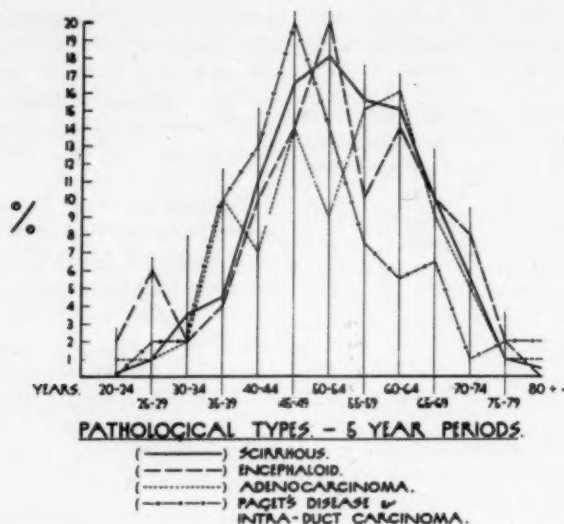


FIG. IV

(F) Correlation of clinical and pathological stages

It is of interest to compare the clinical staging before operation with the pathological staging obtained after examination of the breast and axillary glands. (Figures from one hospital.)

Clinical Stage	Pathological Stage	Per Cent.
1 (206)	1	64
	2	36 = 100 per cent.
2 (182)	1	16
	2	84 = 100 per cent.

FIG. V

The table (Fig. V) gives some indication of the degree of error likely to be involved in a clinical assessment in Stages 1 and 2.

(G) Effect of preliminary biopsy

The influence of preliminary biopsy was investigated in a series of 300 consecutive cases at one hospital. The type of patient for which this examination was considered necessary was one where the diagnosis was

in doubt and the disease small and circumscribed. A preliminary biopsy was performed in 48 patients, followed by a radical mastectomy. The biopsy in most instances was an excision of the whole lesion.

Survival time Stage 1 with biopsy
= 7.8 years.

Survival time Stage 1 without biopsy
= 6.5 years.

Survival time Stage 2 with biopsy
= 4.8 years.

Survival time Stage 2 without biopsy
= 3.8 years.

It will be seen that these patients had a better survival rate than those in which biopsy was not considered necessary. From this series it appears that preliminary biopsy does not unfavourably influence the outcome.

(H) Treatment

The treatment of carcinoma of the breast falls naturally into three groups:

1. Radical surgery with or without supplementary radiotherapy.
2. Conservative surgery, i.e. simple mastectomy or wedge excision with or without radiotherapy.

3. Radiotherapy alone.

The indications for these methods of treatment overlap but in this series, radical mastectomy with or without radiotherapy has been preferred when it has been thought possible to eliminate the disease entirely, i.e. in Stages 1 and 2. The other forms of treatment have been largely reserved for those patients considered to be beyond the field of curative surgery or for those patients who, from general systemic disease or age, have a limited expectation of life. This series was taken from patients admitted to hospital and it might be argued that it would contain a larger than usual number of cases suitable for operation, hospitals being notoriously averse to admission of patients suffering from advanced malignancy. It will be shown later, however, that there is a very close parallel between the survival rate of this series and a large untreated series over the initial 2 years, and this suggests that it comprises a group of relatively unselected patients.

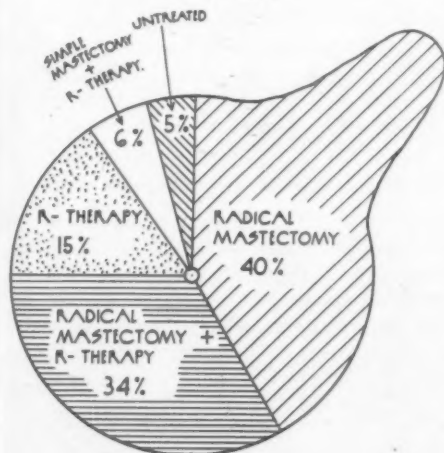


FIG. VI

Radical surgery was employed in 74 per cent. of patients in the series with supplementary deep X-ray therapy in 34 per cent. of these patients. Radiotherapy alone was utilized in 15 per cent. Conservative surgery with or without radiotherapy was the method employed in 6 per cent. and in 5 per cent. of the series patients were untreated or the treatment was not specified.

(I) Trends in treatment

It is interesting to note that during the period of the survey, the treatment of this disease appears to have become stabilized.

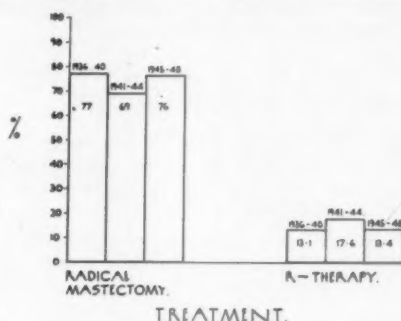


FIG. VII

The proportion of patients treated by radical surgery and by radiotherapy alone has remained practically unaltered (Fig. VII). This proportion was common to all four hospitals with variations of only a few percentage points. In this series 85 per cent. of Stage 1 and 94 per cent. of Stage 2 were submitted to radical surgery. However, more patients in the period 1945-1948 were being referred for post-operative radiotherapy than in the period 1936-1940, the proportion rising from approximately 30 per cent. in the former period to 40 per cent. in the latter period.

(J) Operative mortality

The operative mortality of the series following radical mastectomy was 2.3 per cent. and no appreciable alteration occurred with the introduction of the antibiotics or improved methods of resuscitation, as shown in the following table:

OPERATIVE MORTALITY — RADICAL MASTECTOMY

1936-1940	1941-1944	1945-1948	Total
2.65	1.94	2.36	2.34
per cent.	per cent.	per cent.	per cent.

In the calculation all deaths occurring within one month of operation were considered to be post-operative deaths. Many of the deaths were due to systemic disease. However, about one-third were due to post-operative shock, reactionary haemorrhage or pulmonary embolus.

(K) Results of treatment — radical surgery and radiotherapy in Stages 1 and 2

Stages 1 and 2 have been selected because they are the more favourable group of patients to treat and will more readily indicate improvements in the survival rates.

In arriving at these survival rates the following considerations are important:

(a) All untraced cases (12 per cent.) have been excluded from the series. The methods of tracing these patients included a search of the records of deaths at the Registrar General's Office. This method would be expected to reveal nearly all those persons who have died in New South Wales.

This is supported by the fact that the percentage of people with disease favourable for cure (Stage 1) is 50 per cent. in the untraced series compared with 35 per cent. in the total series (Table 1).

surgery and 39 per cent. if radiotherapy was given in addition. However, again after 10 years the survival rate was 11 per cent. and

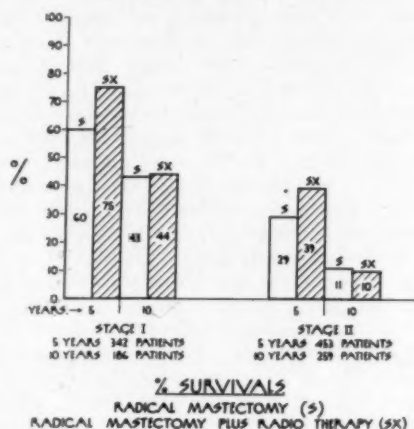


FIG. VIII

TABLE 1
CLINICO-PATHOLOGICAL TYPES—TRACED AND UNTRACED SERIES

Stage	1	2	3	4	Total
All Patients	35 per cent.	40 per cent.	14 per cent.	11 per cent.	100 per cent.
Untraced Patients	50 per cent.	37 per cent.	8 per cent.	5 per cent.	100 per cent.

(b) Intercurrent deaths are considered to account for one in every 8 or 9 deaths and we are satisfied in most cases that they are proved intercurrent deaths. From the life expectancy table of women 53 years of age approximately 10 per cent. will die of intercurrent disease in the next 10 years. However, following the current practice, intercurrent deaths have been included in cancer deaths.

Thus it will be seen that the survival rates to be given will be the least favourable possible.

From Fig. VIII in Stage 1 60 per cent. of patients treated by surgery alone survived 5 years. This survival rate increased to 75 per cent. if post-operative radiotherapy were added. However, after 10 years the percentage survival in each of these groups was 43 per cent. and 44 per cent. respectively. In Stage 2 after 5 years the survival rate was 29 per cent. for those treated by radical

10 per cent. for surgery and surgery plus radiotherapy. Thus it would appear that deep X-ray therapy following radical mastectomy increases the 5 year survival rate 15 per cent. in patients with cancer of the breast in Stage 1 and 10 per cent. in Stage 2 but has little effect in the 10 year survival rate.

The following table (Fig IX) shows the survivals after radiotherapy alone at one hospital (124 patients).

Pathological confirmation of the diagnosis was seldom available. The number of patients treated in Stages 1 and 2 were small and most of them were in Stages 3 and 4.

The results were generally inferior to surgery in Stages 1 and 2.

Has treatment altered the course of the disease?

STAGE YEARS

I	5	7/15	46.6%
	10	1/10	10%
II	5	5/10	50%
	10	1/8	12.5%
III	5	5/47	10.6%
	10	3/24	12.5%
IV	5	0/52	—
	10	0/27	—

% SURVIVALS AFTER R-THERAPY ONLY
5 & 10 YEARS — R.P.A.H.

FIG. IX

It is interesting to compare the survival rate of the whole group of patients in the present series with that of an untreated group of patients (Greenwood) (Fig. X).

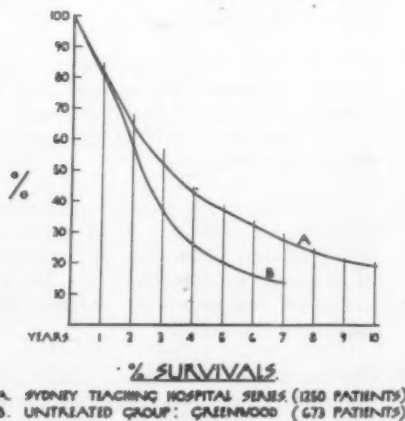


FIG. X

Treatment apparently plays little part in increasing the total survival rate during the first 2 years, but following that period treatment improves the prospects of survival by approximately 10 per cent. to 15 per cent.

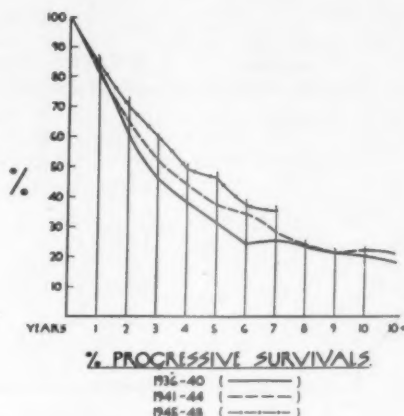


FIG. XI

(L) Improvement in survival rates

The survival curve is higher in the later period of the survey (Fig. XI). Some of this improvement will be due to fewer deaths occurring from intercurrent diseases. However, there still appears to be an improvement amounting to approximately 10 per cent. in the survival rate from the disease itself. This improved survival rate is a matter of some encouragement.

(M) Comparison with series — University of California

A survey from the University of California was most closely comparable to the present series by virtue of the methods of analysis and correlation of data.

It will be seen from the above table that the survival rates in the present survey are lower than those in the University of California series. A significant factor here may be that the percentage of untraced cases was only 3 per cent. in the overseas series whereas untraced cases from the Sydney Teaching Hospital group comprise 12 per cent. and the proportion of favourable Stage 1 growth among the untraced patients was disproportionately high.

TABLE 2
COMPARISON OF STAGES 1 AND 2

Stage	Survival	Sydney Teaching * Hospitals	University of California
1	5 year	67.5 per cent. (423)	72.5 per cent. (280)
	10 year	43.5 per cent. (241)	57.8 per cent. (161)
2	5 year	34.0 per cent. (517)	42.2 per cent. (270)
	10 year	10.5 per cent. (295)	24.3 per cent. (173)

SUMMARY AND CONCLUSIONS

- 1,432 patients (12 of whom were males) suffering from cancer of the breast were admitted as in-patients to the four teaching hospitals of Sydney during the years 1936-1948 inclusive. The series has been divided into three groups as follows: 1936-1940, 1941-1944 and 1945-1948 for purposes of comparison.
- The 5 and 10 year survival rates were not influenced by:
 - (a) The age of the patient at the onset of the disease, with the exception that the 10 year survival rates of the younger patients was higher, a finding to be explained by the occurrence of fewer intercurrent deaths.
 - (b) The length of history or time elapsing prior to treatment for the first six months. After this period for length of histories up to 2 years, the survival rates were lower but not appreciably so.
 - (c) The site of the tumour within the breast.
 - (d) Preliminary biopsy excision.
- Owing to insufficient information it was not possible to draw conclusions regarding the effect of previous child bearing.
- The histological types of scirrhus and of encephaloid growths were the most malignant.
- Treatment in this series improved the survival rate by 10 per cent. to 15 per cent. when compared with an untreated series (Greenwood). The survival rate was higher in the period 1945-48 than in 1936-1940.
- The proportion of patients treated by radical mastectomy and by radiotherapy alone was the same in all periods under consideration (i.e. 1936-1940, 1941-1944 and 1945-1948). In the last period more patients were being referred for post-operative radiotherapy.
- Radiotherapy following radical mastectomy increased the survival rate in Stage 1 and Stage 2 by 10 per cent. to 15 per cent. but had little effect on the 10 year survival rate.
- The technique of simple mastectomy followed by radiotherapy as advocated by McWhirter (1948) or the operation of bilateral oophorectomy in advanced malignant disease, were seldom performed in this series.
- Oestrogen and androgen therapy were not used during the period of the survey.
- The view was confirmed that radical mastectomy had little to offer the patient once the disease had obviously spread beyond the operative field.
- The chance of survival fundamentally depends on the inherent malignancy of the growth. Whereas early diagnosis

will certainly prevent a Stage 1 growth entering the unfavourable Stage 3, it has not been proved that early diagnosis will appreciably alter the chances of distant spread in the more virulent growths. In the opinion of the authors, any radical improvement in the results of treatment of cancer of the breast must await the introduction of hormonal or other biochemical agents which may selectively interfere with malignant cell metabolism.

ACKNOWLEDGEMENTS

It is desired to thank the Honorary Surgical and Radiotherapeutic Staff of the four Teaching Hospitals of Sydney for permission to include their patients in this series. A grant of money from the Medical Board of the Royal Prince Alfred Hospital to aid this investigation is acknowledged.

It is also desired to thank Dr. V. J. McGovern (Pathology Department, the Royal Prince Alfred Hospital), Dr. S. Bray (Radiotherapy Department, the Sydney Hospital)

and Dr. J. Garvan (Pathology Department, St. Vincent's Hospital) for their help and advice. The valuable assistance of the following Registrars is gratefully acknowledged: Dr. M. Nelson, Dr. N. Hardwicke and Dr. D. Perry. We are grateful to Miss J. Plowman for help in correlating the figures of all hospitals.

Finally we wish to thank Miss S. Dovey (Almoner's Department, St. Vincent's Hospital), the Registrar General of Births, Deaths and Marriages, Sydney, and the Criminal Investigation Branch, Sydney, for their help in tracing patients.

REFERENCES

- GREENWOOD, M. (1926), "Natural Duration of Cancer," British Ministry of Health Reports on Public Health and Medical Subjects, No. 33. London, H.M. Stationary Office.
- LANCASTER, H. O. (1951), *Med. J. Aust.*, vol. 2, page 1.
- MCWHIRTER, R. (1948), *Amer. J. Roentgenol.*, vol. 62, page 335.
- SHIMKIN, M. B., LUCIA, E. L., STONE, R. S. and BELL, H. G. (1952), *Surg. Gynec. Obstet.*, vol. 94, page 645.

ANTRODUODENECTOMY AND X-RAY IRRADIATION IN THE TREATMENT OF DUODENAL ULCER

A PROGRESS REPORT

By GRAYTON BROWN

and IAN J. WOOD*

*From the Royal Melbourne Hospital and the Walter and Eliza Hall Institute of Medical Research,
Melbourne*

THE stimulus for developing this more conservative surgical treatment for duodenal ulcer, antroduodenectomy followed by X-ray irradiation, was the somewhat unsatisfactory result in a personal series of patients treated by one of the standard operations—Polya subtotal gastrectomy using an antecolic Balfour type of anastomosis with no valve. The immediate mortality was low there being only one death from coronary occlusion in 95 consecutive operations. However the follow up was disappointing. Forty-four patients were available for constant observation and in 9 there was considerable disability from symptoms which have been generally included in the term "post-gastrectomy syndrome." The symptoms have consisted of daily attacks of nausea followed by the vomiting of bile. This was accompanied by considerable loss of weight and lack of energy. Four of these patients have been subjected to a further operation, entero-enterostomy, with some relief of symptoms but without restoration of weight. Two others are to have a similar operation in the near future.

In addition to these there were eleven patients who were weaker than normal and suffered from fullness during meals but the symptoms were not disabling. Thirty-two patients had failed to regain their normal weight and were more than 7 lbs. below their weight at the onset of ulcer symptoms. There were no cases of anaemia, "dumping" or tuberculosis as has been discussed by other writers (Watson, 1947; Smith, 1951; Warthin, 1953).

It was considered that these results, although an improvement on those of a decade ago, could not justify complacency. Moreover, overseas authors publishing results of

other techniques of subtotal gastrectomy, where a close personal follow up was carried out, experienced similar failures (Moroney, 1954; Schmitz *et alii*, 1954).

It does not seem that any minor alteration of technique affects the results.

Only those results based on regular personal interviews are worthy of consideration. Follow up by post is particularly unreliable.

PLAN OF TREATMENT

After giving the problem much thought a plan of treatment was evolved in 1952 (Brown *et alii*, 1952) and this has been retained, with minor modifications.

1. *Resection of the duodenal ulcer* was considered desirable if possible. In the majority of cases the size of the ulcer and its distance from the ampulla rendered it possible for an experienced surgeon to excise the ulcer and adjacent scar tissue, at the same time leaving a cuff of healthy duodenum distally which was sufficient to anastomose with the stomach.

2. In most cases the proximal extent of the fibrosis necessitated excising the pylorus. It was therefore decided to include both the pylorus and the gastric antrum, the latter having gained a reputation for producing recurrent ulceration.

This limited resection, antroduodenectomy, ensured that the stomach remaining was of generous capacity—in actual measurement it was found to average approximately 18 cms. along the lesser curvature and 26 cms. along the greater curvature.

3. *Alimentary continuity was maintained* by means of a gastro-duodenal anastomosis so that the food leaving the stomach would, by passing through the duodenum, give rise

*Working with the aid of a grant from the National Health and Medical Research Council of Australia.

to normal reflex secretion of bile and pancreatic juice, and also would allow thorough mixing of these secretions with the food. This would be a big advantage over the Billroth II operation where normal physiology is greatly disturbed.

4. *Healing by first intention* was regarded as being most important and to assist this an antibiotic "cover" of penicillin and streptomycin was given by intramuscular injection immediately before and following operation. Moreover while the anastomosis was being carried out a topical application of penicillin in a readily soluble lactose base was employed.

The blood supply to the cut edges was preserved by limiting the ligation of the blood vessels to the level of the section of the stomach and duodenum. Interrupted silk sutures in two layers were used for the anastomosis in the early cases, however the mucosal layer was later changed to interrupted catgut, because the silk sutures were observed by gastroscopy to remain for many months and might lead to recurrent erosion of the surrounding mucosa, as has been noted by Tanner (1954).

A stay of one week in hospital before operation was considered advisable to reduce local inflammation; this of course was not possible where bleeding or stenosis demanded an emergency operation.

5. *X-ray irradiation was administered to the body of the stomach* two months after antroduodenectomy in order to counter the high acid secretion which remained after this limited resection (Scott *et alii*, 1953). During the interval between operation and X-ray irradiation alkaline powder and belladonna were administered.

6. *The indications for surgery remained conservative.* Severe bleeding, recurrent stenosis, or chronic pain preventing the patient being able to continue a reasonable economical or social life were required to be present before operation was undertaken.

SURGICAL TECHNIQUE OF ANTRODUODENECTOMY

The following technique is that at present being practised, and, with minor modifications, was employed throughout the series.

The stomach is divided transversely approximately 5 cms. above the pylorus, the right gastric and gastro-epiploic vessels being ligated at the level of the section to preserve the blood supply (Brown, 1954). The cut edge of the stomach is narrowed to the diameter of the duodenum by suturing the excess on the lesser curvature side. The duodenum is dissected off the pancreas until the gastro-duodenal artery is exposed. In the majority of cases the ulcer will have been passed and healthy duodenum freed. If the ulcer with its surrounding fibrous tissue extends further than this from the pylorus, then the common bile duct should be exposed before the duodenal branches of the gastro-duodenal artery are ligated and divided to further liberate the duodenum. The common bile duct is in danger where it is in relation to the upper border of the duodenum before passing down behind the pancreas.

The opening in the stomach is anastomosed to the duodenum by two layers of sutures, an outer layer of interrupted silk sutures and an inner layer of fine interrupted catgut sutures. The mucosa of the opened duodenum is carefully inspected to ensure that no further ulceration or fibrosis remains.

If during mobilization it is suspected that the ulcer and surrounding fibrous tissue extend too far down the first part of the duodenum, then the duodenum should be opened and the ulcer inspected. If the suspicion is allayed by the presence of a good portion of healthy mucosa in the first part of duodenum distal to the ulcer and surrounding fibrous tissue, then resection should proceed. This may be facilitated by placing the left index finger inside the duodenum whilst the ulcer is dissected off the pancreas.

The occasional ulcer which extends too far distally should be left undisturbed, the duodenum being closed proximally and a Billroth II anastomosis carried out.

DETAILS OF SERIES

The series consisted of 81 consecutive patients treated in both private and public hospitals. The public hospital patients were managed by the Clinical Research Unit of the Royal Melbourne Hospital and Walter and Eliza Hall Institute. In all there were 67 males and 14 females, the average age being

fifty-two years—range 24 to 83 (Fig. 1). All patients were available for constant follow up by the Unit. Sixty patients were operated on by one of us (J.G.B.), the remaining 21 by Mr. Julian Smith, Mr. E. S. R. Hughes and Mr. Graham Mackenzie, who were extremely helpful in carrying out this work at our request.

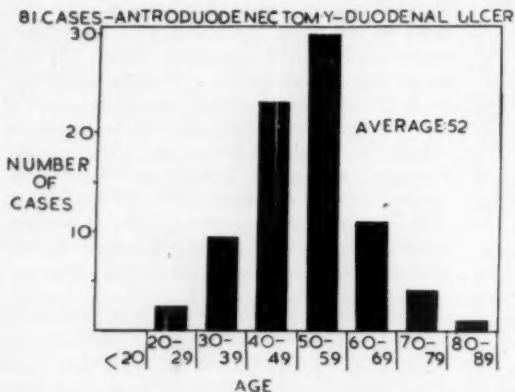


FIG. 1. Showing the age distribution in the 81 patients subjected to antroduodenectomy for duodenal ulcer. Of these 44 were given X ray irradiation to the body of the stomach two months after operation in order to reduce the secretion of acid and pepsin.

The reason for operation in the series was as follows: pain, 28 cases; pain and haemorrhage, 29 cases; pain and obstruction, 20 cases; pain, haemorrhage and obstruction, 4 cases

There were 9 patients who had had previous operations for perforation. In 7 patients the operation was performed in an emergency for acute severe bleeding.

Associated diseases in these 81 patients provided a problem in assessing the value of surgical treatment. They were as follows: chronic nephritis, 1; hypertension, 6; mitral stenosis, 1; coronary sclerosis with failure, 1; asthma, 2; rheumatoid arthritis, 2; alcoholism, 5; cirrhosis of the liver 1; senility, 2.

Barium meal

Apart from the clinical history and physical signs, X-ray examination with barium meal was the most informative diagnostic test for duodenal ulcer. This results are discussed in Dr. Davis' paper which follows this contribution.

Gastroscopy before operation

Gastroscopy was carried out before operation in 34 cases. In two cases a small acute ulcer was seen in the antrum. These findings were confirmed at operation where a chronic duodenal ulcer was also present. In another case of chronic duodenal ulcer two small antral ulcers were also found at operation and these were not seen at gastroscopy. There were seven cases where an ulcer in the pylorus was found at operation but was not seen at gastroscopy.

Gastroscopy was of assistance in eliminating the possibility of a pre-antral ulcer being associated with the duodenal ulcer, but the above findings indicate its limited value in the diagnosis of associated pyloric or antral ulcers. Of course gastroscopy was of no value in the diagnosis of duodenal ulcer.

Nature of resected specimen

All ulcers had some extension to the posterior wall and the majority were adherent to the pancreas or, less frequently, to the liver. Twenty-two of these had penetrated completely, the pancreas or liver forming the floor of the ulcer.

The distance from the pylorus to the proximal edge of the ulcer averaged 1.1 cms. The average maximum diameter of the ulcer crater was 1.2 cms. but the fibrous tissue extended further—the reason for this apparently high measurement was that many of the craters were transversely situated, beginning on the posterior wall and then extending upwards and anteriorly round the lesser curvature aspect of the duodenum.

In 22 cases there was more than one ulcer, there being 4 in one case. In 6 cases there was a diverticulum caused by the contraction of fibrous tissue associated with the ulcer.

Ulcers unsuitable for resection

Since this series began there have been 7 duodenal ulcers which were considered too large or unsuitably placed for resection, so the duodenum was closed proximal to the ulcer and a Billroth II operation was carried out.

Previous to this, in the early cases of our series, an attempt had been made to resect all ulcers and this led to two fatalities in cases where the ulcers extended to the junction of the first and second parts of the duodenum. In two other cases where subsequent anastomotic ulceration occurred, pre-operative barium meal examinations, inspection at operation and close inspection of the resected specimen had suggested that the ulcer was situated too far distally for safe resection—this was only appreciated in the light of subsequent experience.

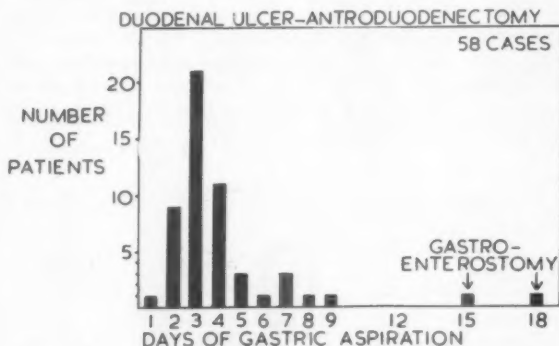


FIG. II. Length of time after antroduodenectomy the Rehffuss tube was left in the stomach for purposes of intermittent aspiration. It will be noted that two of the 58 patients had a prolonged hold up at the site of anastomosis. This was relieved by gastroenterostomy, both patients then progressing favourably.

IMMEDIATE POST-OPERATIVE COURSE

The Rehffuss tube was allowed to remain in the stomach till good bowel sounds were audible and when frequent small drinks were being taken without any accumulation as shown by two to four hourly aspirations. The number of days which elapsed before the aspirations from the Rehffuss tube had decreased sufficiently to remove it has varied as is shown in Fig. II, the average time being 4.4 days, and the range from one to eighteen days.

In two of the early cases "hold up" at the anastomosis rendered it necessary to carry out a gastro-enterostomy fifteen and eighteen days respectively after operation. Both these cases were progressing favourably twenty-eight months and twenty-nine months respectively after operation.

Other post-operative complications were as follows:

One patient aged eighty-three years had a right basal bronchopneumonia—as with all upper abdominal operations it is important for patients to learn deep breathing and coughing before operation and to practise them after operation. There were two cases of minor pulmonary infarct, one being in a patient with pronounced mitral stenosis. One patient had an attack of severe pain and vomiting immediately after discharge from hospital. He suffered from chronic nephritis and his blood urea was always over 100 mgm. per cc. Only one patient had slight jaundice and this was the result of cutting the common bile duct during quick mobilization of the ulcer in an emergency operation for bleeding in the eighty-three years old man. The duct was immediately repaired with interrupted silk sutures and he progressed favourably for the next two years. There was one case of prolonged wound infection in a patient who was operated on in an emergency for severe haemorrhage and suffered from cardiac failure with ascites; he subsequently progressed very well. One patient had two attacks of severe epigastric pain within four weeks of operation but responded completely to rest

and has had no symptoms since. In all cases of gastrectomy there is probably some inflammation at the anastomosis during the immediate post-operative period and some patients will suffer epigastric pain during this time.

Of the 81 patients subjected to antroduodenectomy there were two immediate post-operative deaths—one three weeks after operation due to choleperitoneum following damage to the common bile duct, and the other nine weeks after operation due to erosion of the gastro-duodenal artery by a leaking anastomosis causing a fatal haemorrhage. Both these elderly patients had ulcers which were very large and extended to the junction with the second part of the duodenum—we now regard this to be a contra-indication to antroduodenectomy.

PROGRESS AFTER DISCHARGE FROM HOSPITAL

The remaining 79 patients were followed up after their discharge from hospital for periods ranging up to nearly three years, and the study was mostly made in considerable detail by personal interrogation, physical examination and testing. Of course most attention was paid to the symptoms and signs relating to the stomach and duodenum. However, often difficulties in assessment were created by the associated conditions which have already been mentioned. Three patients died during the period of follow up from causes not directly related to the operation, one aged forty-five years dying seven months after operation from acute pancreatitis and neglect after a severe and prolonged alcoholic bout, autopsy revealing normal stomach and duodenum; one aged sixty-nine years dying five months after operation from severe cirrhosis of the liver with liver failure, again the stomach and duodenum were normal at autopsy; and the third aged eighty-three years dying two years after operation from senile dementia, malnutrition and terminal bleeding into the alimentary canal and probably the brain, an autopsy not being held as he died at home. These three patients were included in the follow up series and assessed with regard to their gastrointestinal symptoms up to the time of their final illness.

The 79 patients were assessed by personal examination at regular intervals with particular reference to their appetite and amount eaten at a meal, and to the presence or absence of discomfort, pain, nausea or vomiting. Considerable emphasis was placed on their general sense of well-being, and their ability to work and lead a successful domestic life. In these studies we were greatly aided by our dietitian, Miss C. N. Turner, and our social worker, Miss M. A. Mackay. Other useful objective observations were the presence of abdominal tenderness, the measurement of weight, and the haemoglobin concentration. And lastly serial histamine test meals and one or two barium meals completed the study.

The duration of the follow up of the 79 patients averaged fifteen months and ranged from one to thirty-two months.

Most patients returned to their occupation within two months of operation, the average time being seven weeks, and the range four to twelve weeks. Under the term "occupation" we have included home duties, a few elderly patients only undertaking work entailing minor stress. Seventy-one of the 79 patients returned to the same occupation, four to different occupations which were more strenuous, one to a less strenuous occupation and three to an occupation which was judged to have the same stress. The patients were weighed at each visit and most gained weight very satisfactorily—they soon showed an increase over their pre-operative weight. This is illustrated in Fig. III.

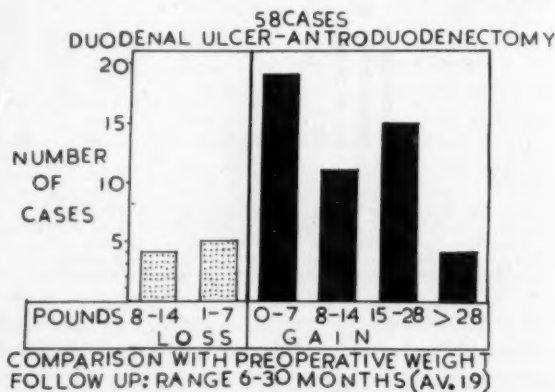


FIG. III. Showing that most patients gained weight or maintained their weight following antroduodenectomy for duodenal ulcer. Some of the patients had received X-ray irradiation, but they showed no significant difference from those not receiving irradiation.

In the majority of patients the haemoglobin level remained high, the average of forty-nine patients serially tested being 13.7 grams.

X-ray irradiation of the stomach

When the present project was begun it was resolved to subject all patients to X-ray irradiation two months after antroduodenectomy in order to lower the secretion of acid and pepsin and thus to reduce the likelihood of recurrent ulceration, particularly at the site of anastomosis. After ten months had elapsed in our study most of the patients were progressing splendidly.

However it was decided to employ antro-duodenectomy without X-ray irradiation in a control group collected by random selection. We were encouraged to do this by the fact that several patients had not received irradiation owing to domestic circumstances and they were also progressing favourably—it might be that the high acidity which remained after antro-duodenectomy would, in fact, fail to produce a high incidence of recurrent ulceration so long as the mucosa at the line of anastomosis underwent healing by first intention. This primary healing would be aided by careful surgical apposition of the mucosal surfaces, by antibiotics and by the other modern refinements of surgery.

The majority of patients worked during the period of irradiation, the treatments being given in the late afternoon. The irradiation effects were not pronounced—41 patients experienced either no symptoms or slight nausea, and 3 moderate nausea and loss of appetite. It was deemed wise to keep some elderly patients in hospital during this treatment.

The effect of the X-ray irradiation on gastric secretion was assessed by serial histamine test meals, tests being made of the acidity and pepsin concentration. The accompanying graph (Fig. IV) shows the depression in acid secretion which followed the irradiation. It is interesting to compare the test made three

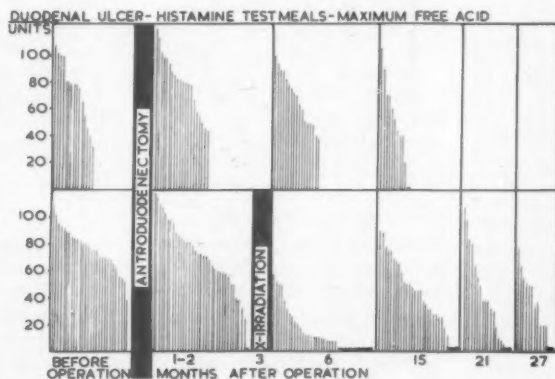


FIG. IV. The results of serial histamine test meals in patients subjected to antro-duodenectomy for duodenal ulcer. Each vertical line represents the maximum free acid in response to 0.3 milligrams of histamine; each dot represents achlorhydria. It will be noted that the group receiving X-ray irradiation to the body of the stomach, beginning two months after operation, had a reduction of the acid secretion; however this reduction was not usually maintained. More tests are required to provide significant results in the long-term groups.

In this control group 35 cases of duodenal ulcer have now been treated by antro-duodenectomy alone whereas in the test group 44 cases have been treated by both antro-duodenectomy and X-ray irradiation.

The 44 patients receiving X-ray irradiation after antro-duodenectomy were given a three weeks' course totalling 2,000r (41 patients) or 1,500r (3 patients); 2,000r proved to be the more satisfactory dose. Every care was taken to centre the irradiation accurately over the stomach. For evolving the technique of irradiation we are indebted to Dr. Kaye Scott and Dr. Holman (1953) of our Hospital.

months after irradiation with the test made at a corresponding time in the control group which received no irradiation—there is a considerable reduction in acid secretion in the irradiated group. It will also be observed from the graph that in the irradiated group there was a gradual rise in the acid after three months till often normal levels were reached. However, the hyperchlorhydria typical of duodenal ulcer was seldom encountered. Sufficient patients have not as yet been tested in the long range groups to provide significant results.

RESULTS OF THE FOLLOW UP IN THE IRRADIATED AND NON-IRRADIATED GROUPS

In the 44 patients receiving irradiation after antro-duodenectomy the average time of follow up was eighteen months and the maximum thirty-two months; and in the 35 patients of the control group receiving no X-ray irradiation after antro-duodenectomy the average time of the follow up was twelve months and the maximum thirty months (Table 1). Of the irradiated group 41 were assessed as "very good," one as "moderately good," and two as "poor." In the control group who received no irradiation twenty-seven were classified as "very good," six as "moderately good," and two as "poor."

TABLE 1

Follow up of 79 patients discharged from hospital after antroduodenectomy for duodenal ulcer showing the results in the group receiving X-ray irradiation after operation and in the group receiving no irradiation.

Received X-ray irradiation — — — — —	44	
(Average time of follow up—18 months)		
Received no X-ray irradiation — — — — —	35	
(Average time of follow up—12 months)		
	Received X-ray Irradiation	Received No X-ray Irradiation
Very good	41	27
Moderately good	1	6
Poor	2	2
	44	35

These results do not as yet provide sufficient evidence to indicate the better form of treatment, but one is tempted to predict that the group treated by antroduodenectomy and irradiation will ultimately yield better results. However we must await a longer period of follow up and an increase in numbers.

It is interesting to review the four patients classified as "poor." Two came from the irradiated group and two from the non-irradiated group.

Case 1

A male aged fifty-three years with associated chronic nephritis developed an anastomotic ulcer. A Polya subtotal gastrectomy was performed thirteen months after antroduodenectomy and X-ray irradiation and he has remained well for fourteen months.

The barium meal findings in this patient have been discussed by Davis (1954).

Case 2

A male aged forty-two years developed an anastomotic ulcer and Polya gastrectomy was performed eight months after antroduodenectomy, no irradiation having been given. He has remained well for five months.

Case 3

A male aged sixty years suffered from melaena and some pain probably from an anastomotic ulcer. He was admitted to hospital for medical treatment

twenty-one months after antroduodenectomy and irradiation, and has progressed favourably for five months.

Case 4

A female aged forty years suffered an acute anterior perforation just proximal to the line of anastomosis seven months after antroduodenectomy without subsequent irradiation. For several months prior to this perforation she had indulged excessively in alcohol and there were signs of malnutrition. The perforation was treated by simple oversewing followed two months later by X-ray irradiation. She has remained well for eight months except for an occasional alcoholic bout.

Gastroscopy after antroduodenectomy

It is interesting to note that thirteen patients were gastroscopied at varying times after antroduodenectomy and in all the site of the anastomosis appeared normal. However the full extent of the anastomosis could not be seen—thus in the two patients in whom an anastomotic ulcer was found at subsequent operation, no ulcer was seen. It is probable that this was in part due to the outward retraction of the ulcer by surrounding scar tissue.

The good results

Finally it must be emphasized that 68 of the 79 patients thus followed up were assessed as showing "very good" progress. Their appetite was good and they eat large meals without discomfort, a strong argument in favour of leaving a stomach of large capacity. There was no evidence of the "dumping syndrome." They possessed an excellent sense of general well-being. They were fit both mentally and physically, commensurate with their age and general bodily physique. Their progress was most gratifying. It was indeed a pleasure to review them from time to time.

And what of the future? Our endeavour now is twofold: firstly to seek out and remedy the causes for the few who did not show "very good" progress, and secondly to assess whether X-ray irradiation is a useful adjunct to antroduodenectomy.

It is our present opinion that antroduodenectomy with end to end anastomosis will prove to be the operation of choice for most cases of duodenal ulcer requiring surgery—it retains a stomach of generous capacity and retains the normal passage for food. It will be the operation of choice where the ulcer is confined to the proximal part of the first part

of the duodenum, and this will comprise the majority of the cases. We have a somewhat open mind regarding the value of giving X-ray irradiation, but at present we definitely favour its use. The passage of time, careful observation and increasing numbers will provide the answer.

SUMMARY

1. The wisdom of practising conservative surgery, antroduodenectomy, in the treatment of duodenal ulcer is emphasized.
2. The surgical technique of antroduodenectomy with gastro-duodenal anastomosis is described, particular attention being paid to the selection of suitable cases for carrying out this operation and to the necessity of obtaining healing of the suture line by first intention.
3. Antroduodenectomy should be confined to patients with an ulcer situated in the proximal part of the first part of the duodenum—this includes the majority of patients requiring surgery.

In 81 patients there were two post-operative deaths, both of whom had large ulcers extending to the junction of the first and second parts of the duodenum.

4. The patients subjected to antroduodenectomy were divided into two groups, the test group (44 cases) receiving X-ray irradiation to lower the high secretion of acid and pepsin which remained after antroduodenectomy, and the control group (35 cases) receiving no X-ray irradiation. The average time of follow up in the patients receiving X-ray irradiation was eighteen months (maximum thirty-two

months) and in the patients receiving no X-ray irradiation the average time of follow up was twelve months (maximum thirty months).

The limited number of patients and the short time of follow up do not as yet provide a significant difference between the two groups but at present the use of X-ray irradiation two months after operation is favoured.

ACKNOWLEDGEMENTS

We wish to thank our colleagues on the staff of the Royal Melbourne Hospital for their generous help and guidance with this work. We are also deeply grateful to the members of the Clinical Research Unit for the part they have played in making the studies in morbid anatomy and biochemistry. Our special thanks are due to the staff of the Clinical Research Ward, particularly to Sister M. Hughes and Sister P. McCartin.

REFERENCES

- BROWN, G., SCOTT, R. K., HOLMAN, W. P., WOOD, I. J., FINCKH, E. S., WEIDEN, S., DAVIS, P. (1952), *Lancet*, vol. 2, page 1145.
- BROWN, G. (1954), *Brit. J. Surg.*, vol. 41, page 359.
- MORONEY, G. E. (1954), *Brit. med. J.*, vol. 1, page 1186.
- SCHMITZ, E. J., HARKINS, H. N., MOORE, H. G., OLSON, H. H. (1954), *Lancet*, vol. 2, page 4.
- SCOTT, R. K., HOLMAN, W. P., FINCKH, E. S. (1953), *J. Fac. Radiol.*, vol. 5, page 42.
- SMITH, W. H. (1951), *Lancet*, vol. 2, page 745.
- TANNER, N. (1954). Personal communication.
- WARTHIN, T. A. (1953), *Amer. J. med. Sci.*, vol. 225, page 421.
- WATSON, A. B. (1947), *Brit. J. Surg.*, vol. 34, page 353.

RADIOLOGICAL FINDINGS IN PATIENTS SUBJECTED TO ANTRODUODENECTOMY FOR DUODENAL ULCER

By P. H. DAVIS

Royal Melbourne Hospital

THE material for this paper has been gathered from 62 of the 81 patients described by Grayton Brown and Wood in this issue and who have been subjected to antroduodenectomy for duodenal ulcer. The 62 patients were selected as they had been examined by barium meal within six months prior to operation. The nature of the operation provides specimens which are unique for comparison with the radiological findings. Such a comparison of operation specimens and X-rays gives much information and encouragement to the radiologist, and he learns much which will enable him to make a more

accurate and confident interpretation. It leads him from the shadows of uncertainty into the light of knowledge.

Of the 62 patients examined the radiological findings were correct in 54. In this assessment we have not taken into account the multiplicity of ulcers. In 6 an error was made in determining the site of the ulcer, all proving to be duodenal whereas the radiologist reported them as being antral (Table 1). Of the remaining two cases no abnormality was detected in one, and it was reported that the other had evidence of a prolapsed gastric mucosa. Both only had a single duodenal ulcer.

TABLE 1

Showing degree of accuracy of report at barium meal examination before operation in 62 cases of duodenal ulcer subsequently proven at operation.

<i>Report correct:</i>	
Crater in duodenum with or without deformity of duodenal cap	14 cases
Deformed duodenal cap, probable duodenal ulcer (including 6 with obstruction)	38 cases
Pyloric crater	1 case
Pyloric obstruction, probably due to ulcer	1 case
Total:	54
<i>Report incorrect:</i>	
Prepyloric crater	6
Prolapsed gastric mucosa	1 case
Nothing abnormal detected	1 case
Total:	8

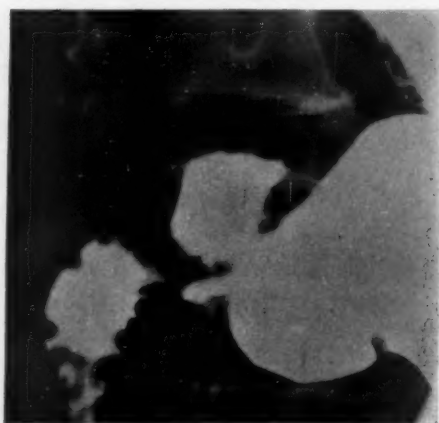


FIG. 1. Barium meal showing deformed duodenal cap. No definite ulcer niche can be seen.

It is noted that an ulcer niche was reported by the radiologist in only 21 patients yet craters were present in the resected specimen in all but one case where the ulcer had healed with stenosis.

The difficulty of demonstrating an ulcer niche in a scarred duodenal cap is well known. The crater is more easily demonstrated in the earlier stages of ulceration; however, it is unusual for an operation to be performed at this stage. With the passage of time, often many years, scarring and deformity increases and the ulcer niche is less easily defined. It is now that the duodenum is resected. This difficulty in demonstrating an ulcer crater is unrelated to the size of the ulcer, both large and small craters often escape detection. (Figs. I and II).

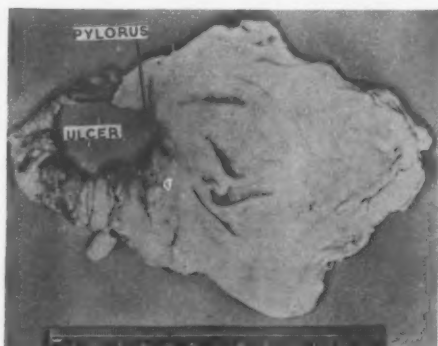


FIG. II. Large penetrating duodenal ulcer removed at antroduodenectomy, corresponding to Fig. I. The size of the ulcer rendered it unsuitable for antroduodenectomy.



FIG. III. Barium meal showing duodenal cap with distally placed niche on superior surface.

Ulcer niches are much less commonly detected when they are in the duodenum than when they are in the pyloric region or

antrum. Scarring does not produce as much deformity in the stomach as it does in the small duodenal cap.

The distance of the duodenal ulcer from the pylorus is of considerable importance in the operation of antroduodenectomy, and this can only be determined when the pylorus can be accurately located and when a niche is present (Figs. III and IV).

The specimens reveal the difficulty of locating the pylorus in films showing an ulcer which causes deformity in the area. This is often recognized by the radiologist, but on occasions scar tissue contraction leads to error.

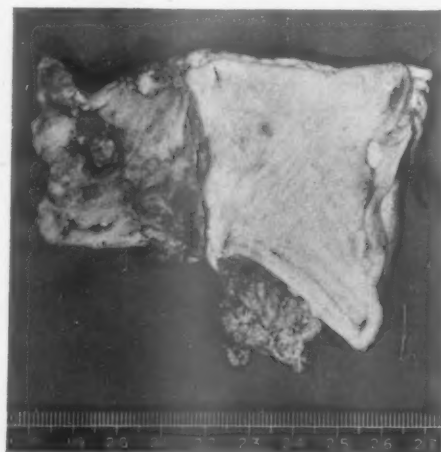


FIG. IV. Specimen removed at antroduodenectomy and showing a chronic duodenal ulcer 2.5 cms. from the pylorus, corresponding to Fig. III.

The mistake was made several times of making a diagnosis of "antral ulcer" where the ulcer proved to be pyloric or duodenal. These ulcers were all thought by the radiologist to be more proximal than the specimens eventually showed.

In 22 patients of 79 where the specimen was carefully examined after removal, more than one ulcer was present. The frequency of multiplicity of ulcers is rather a startling

finding to a radiologist. Barium meal examination was made in sixteen of the patients subsequently shown to have multiple ulcers and in none was multiplicity suspected.

A diverticulum was found at operation in the duodenal cap in 6 patients. These were all thought to be acquired, resulting from contraction of scar tissue. They were not recognized by the radiologist, being reported as "deformed duodenal cap." If recognized they would have provided strong indirect evidence of ulcer.

In one case the diagnosis of "prepyloric ulcer, probably malignant" was made. This ulcer proved to be on the pylorus and innocent.



FIG. V. Anastomotic ulcer occurring in the case of chronic duodenal ulcer subjected to antroduodenectomy, illustrated in Figs. III and IV.

To the radiologist the size of the stomach after antroduodenectomy usually appears about two-thirds the normal. The stomach empties in most respects much the same as a normal stomach. Peristalsis is usually normal and emptying is only a little faster than usual. There is never any dilatation of the duodenal loop as is often found in the jejunum following a Polya operation—in the Polya operation barium empties rapidly from the small stomach remnant, often to distend the efferent loop.

The site of anastomosis following antroduodenectomy is often hard to determine, the mucosae fusing imperceptibly. There may

however be a little irregularity where the cut end of the lesser curvature is closed off. This may lead to difficulty in the differential diagnosis of recurrent ulcer. A definite crater or radiating mucosal folds must be present before a confident diagnosis can be made—minor irregularity is of no consequence (Figs. V and VI).



FIG. VI. Specimen of anastomotic ulcer removed by Polya operation, corresponding to Fig. V.

Antroduodenectomy has brought great benefit to the radiologist by providing specimens with which to check his findings. It has also increased the demands on his skill. He must endeavour to provide more information than "deformed duodenal cap." He must search diligently for a niche and assess its site and size. What is its distance from the pylorus? Is there more than one ulcer? These are questions which the radiologist must make every effort to answer for the surgeon.

ACKNOWLEDGEMENTS

In carrying out this work I wish to acknowledge the help received from Dr. Barbara Wood and members of the Honorary Medical

Staff of the Royal Melbourne Hospital. I am also deeply grateful to Dr. Ernest Finckh, Pathologist to the Clinical Research Unit, for his guidance and for providing the findings in the resected specimens.

RECTAL MANIFESTATIONS OF THE MALIGNANT PROSTATE

By E. R. REAY AND W. L. F. UTLEY

Christchurch

THE differentiation of cancer of the contiguous organs—the prostate and the rectum—is usually not difficult, but in a series of recent cases confusion arose and in one patient the rectum was removed when the malignant lesion was located in the prostate. Both lesions are readily accessible to the examining finger by the same route and both to biopsy by a divergent approach. In three of these cases a biopsy entering the sub-mucous layer of the rectal wall would have revealed an adenocarcinoma of prostatic origin. It has long been held that the fascial covering of the prostate and bladder, while proving no barrier to the forward spread of malignant disease of the rectum or uterus, did prevent infiltration of the rectal wall by carcinoma of the prostate. The following cases shows the belief to be unfounded. The adenocarcinoma of the prostate in its spread often produces distortion of the rectum but its site of origin could usually be readily determined.

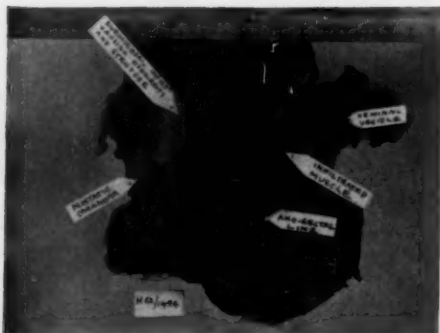


FIG 1A. Lower end of rectum and anus showing attached seminal vesicle and bisected prostate with adenocarcinoma of the last infiltrating rectal wall to produce a nodular constriction of the rectal lumen.

Urinary symptoms generally precede rectal disability, but in some cases the bladder discomfort is minimized and stress is laid on the rectal symptoms. Various authors have noted involvement of the rectum by prostatic cancer, but the literature is not extensive. Young, in

his review of 800 cases, found that the prostate capsule and its double layer of fascia was an effective barrier against invasion of the rectal wall. Only twelve cases were listed in which the rectal wall was actually infiltrated, and in only three was the rectal mucosa ulcerated.

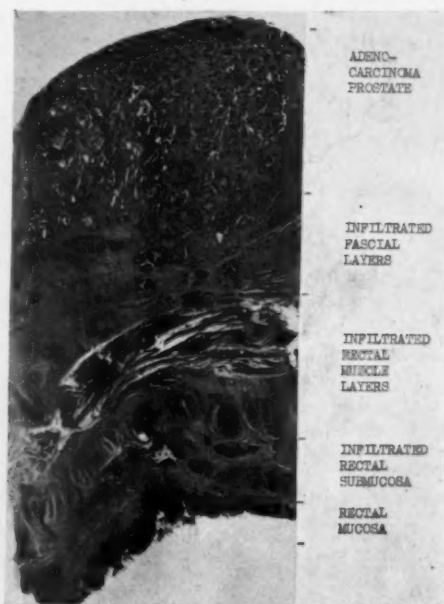


FIG 1B. Section including rectal wall and attached portion of prostate. Adenocarcinoma of prostate infiltrates rectal wall to submucosa.

Cases here presented in the following groups:—

1. The frozen pelvis type with involvement of the prostate, vesicles, bladder base and rectal wall. The diagnosis is not difficult and no type of open operation would be considered. This group will not be further considered.

2. Strictures of the rectum encircling the lumen and either annular or tubular in type.
3. Separate primary malignant tumours in each organ.
4. Cystic mass bulging into the rectum.

This report is not of a large group of cases—simply of six that have appeared in the short space of three years.

into the submucous layer. A slightly deeper biopsy would have shown typical acini of prostatic malignancy.

After operation the patient was unable to pass urine but there was urinary leakage in the perineum from a fistula in the prostatic urethra. Catheter drainage was instituted and the writer saw him at this stage. Large doses of stilboestrol were given and eventually the sinus healed, but retention persisted and a trans-urethral resection eventually restored function. There were no secondary deposits apparent and the serum acid phosphatase was normal.

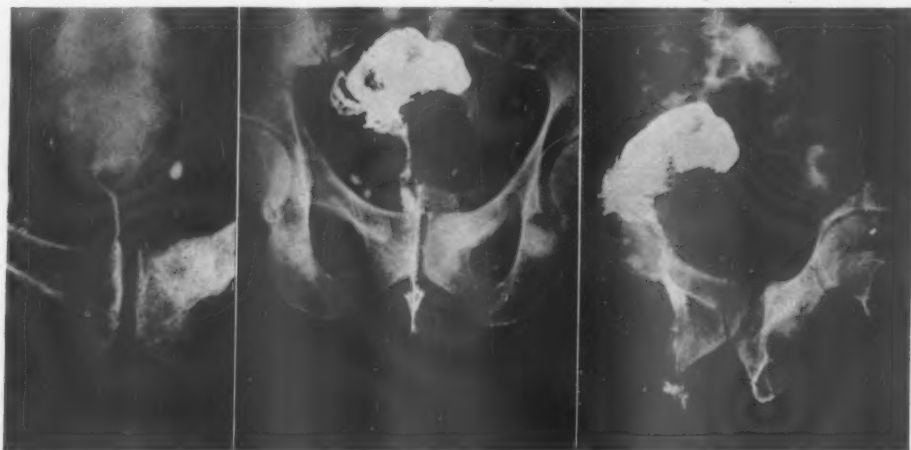


FIG. IIA. A.P. view of cysto-urethrogram showing the narrowed posterior urethra.

FIG. IIB. A.P. view of rectum after running in thick barium paste, showing the long, narrow stricture of the rectum extending right down to the anal margin.

FIG. IIC. An oblique view of IIB with the cysto-urethrogram outline drawn in to give a composite picture.

Case 1

Mr. S., aged 65, had reported to his doctor in July, 1951, for a general examination. Nothing particular was found except that the prostate was noted to be firm and enlarged. Four months later there was slight nocturnal frequency but the urinary stream was unaltered. After a further six months he reported increasing constipation which became worse during the next month and his stools were tape-like. There was no blood or mucus in the motions. There had been no weight loss and no increase in the urinary symptoms.

Rectal examination now revealed a ring stricture of the rectum about the level of the prostate. The sigmoidoscope obstructed here and a rectal biopsy was too shallow and showed only normal mucous membrane. A diagnosis of carcinoma of the rectum, however, was made and the rectum was removed by the abdomino-perineal route and difficulty was experienced in the separation of the rectum and prostate. This operation was done outside the hospital, but the specimen was sent for examination and this disclosed the lesion as an adenocarcinoma of the prostate extending through the rectal wall and

He gradually improved and with a small maintenance dose of hormone is alive and well.

Case 2

L.B., aged 59, was admitted to a surgical ward with a diagnosis of rectal cancer. For the past three years he noticed difficulty in starting micturition and a poorish stream. Two years ago an inguinal hernia was repaired and since there had been gradually increasing constipation and he had lost weight (2 stone) and strength. During the last nine months the constipation had alternated with periods of diarrhoea with gripping abdominal pains and the passage of watery motions. The frequency and difficulty with micturition had also increased. The patient looked ill and dehydrated and had fairly constant abdominal discomfort.

The large bowel was distended and loaded with faeces. Rectal examination revealed a firm stricture of the rectum which would just admit the finger. It was a long, tubular stricture and the upper limit could not be reached, while below it extended to the apex of the prostate. The prostate could not be felt because the examining finger was held in the

long, tubular stricture. The rectal mucosa was intact, and because of this the examining surgeon thought the growth was of extrinsic origin and requested a consultation, and a very doubtful urologist took the case over. However, a plain X-ray of the bony pelvis showed numerous osteoblastic deposits and the serum acid phosphatase was raised. A cysto-urethrogram was carried out and a large amount of residual urine was found. The posterior urethra was narrowed and irregular, suggesting a malignant lesion of the prostate. At the same time some thick barium paste was injected into the rectum to obtain a composite picture of the contiguous organs.

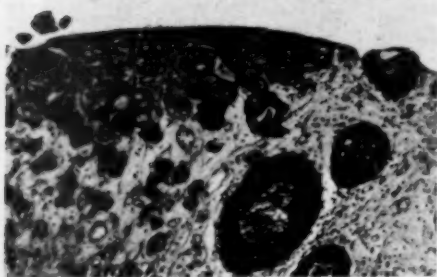


FIG. IIIA. Biopsy rectal mucosa showing carcinoma of prostate infiltrating to surface. Normal rectal glands can be seen on the right.

Resection of the prostate was done and at the time involvement of the trigone was noted.

The sections revealed adenocarcinoma of the prostate and the administration of stilboestrol was continued. The patient began to show rapid improvement in both bowel and urinary function. Now, eighteen months after his discharge, he is well, has regained his weight and is symptom free. Almost complete resolution has occurred in the rectal stenosis and the outline of the prostate can be readily ascertained.

Case 3

This patient, aged 77, was admitted to a surgical ward as a case of rectal malignancy. There had been loose motions for six months culminating in subacute obstruction with no bowel movement for three days. For two months there had been pain in the rectum, especially on defaecating. There was a weight loss of one stone. Urinary difficulty and frequency had been present for two years. The abdomen was distended, bowel sounds were active and a plain X-ray showed uniform distention of the large bowel. Within 1" of the anal margin was a large mass forming a long, tubular stricture which fitted tightly to the examining finger and extended beyond reach of the finger. The prostate could not be defined. It was impossible to pass even a small sigmoidoscope and a rectal biopsy was taken. As it was impossible to relieve his obstruction by enemata he was prepared for a colostomy. However, in view

of the preceding cases, and the fact that in spite of the size of the tumour the rectal mucosa was intact, the registrar was prompted to ask for postponement of the operation. The stricture was dilated under anaesthesia and a rubber tube passed through it and the distention was relieved by irrigation. There were no secondary deposits in the bone and the serum acid phosphatase level was not raised.

The biopsy disclosed the normal structure largely destroyed by an adenocarcinoma of high-grade malignancy. It was composed of small acini which infiltrated the muscle coat and the mucosa. The appearances were considered atypical for primary rectal carcinoma, and other sites — prostate or stomach — were suggested.



FIG. IIIB. Cysto-urethrogram showing very narrow prostatic urethra with superimposed barium paste in rectum showing long stricture at tip of the catheter.

The patient was given 30 mgms. stilboestrol daily and he began to improve almost at once. In a few days he could pass a small tape-like stool and he was discharged to report later.

He was seen again after two months and had been having some four rather loose motions daily. His urinary stream had also improved. The rectal stricture was present, but less dense, and a great deal of the tumour mass had disappeared. The rectum was filled with barium paste and a cysto-urethrogram was performed on this occasion.

Resection of a sclerotic prostate revealed a fairly differentiated adenocarcinoma. There was no apparent infiltration of the trigone.

Case 4

In November, 1949, J.H., aged 82, had a trans-urethral resection for an adenocarcinoma of the prostate. He had then disappeared into the country and discontinued his stilboestrol. In September, 1952, he was sent again to the hospital with a diagnosis of rectal growth, but because of his previous history was admitted to an urological ward.

For the past year he had had severe diarrhoea alternating with obstinate constipation and had lost one stone in weight. Apart from frequency there was no urinary disability. It was impossible to make a rectal examination because just inside the anal canal there was a dense stricture and dilatation of this was intensely painful. Plain X-ray of the lumbar spine and bony pelvis was negative, but the total serum acid phosphatase was 45 units per 100 c.c. serum.

Under anaesthesia proctoscopy showed a firm, smooth, fibrous stricture at the level of the apex of the prostate and extending round the lumen of the canal. The mucosa was intact over it. The stricture could be dilated very little and showed a tendency to tear. A small sigmoidoscope was passed through the constriction and revealed only a few superficial stercoral ulcers.

Biopsy of the obstructing tissue showed normal rectal mucosa and in the submucosa, and especially about the vessels, were groups of cells of prostatic adenocarcinoma.

Stilboestrol therapy was begun and a rapid improvement was noted in the rectal condition.

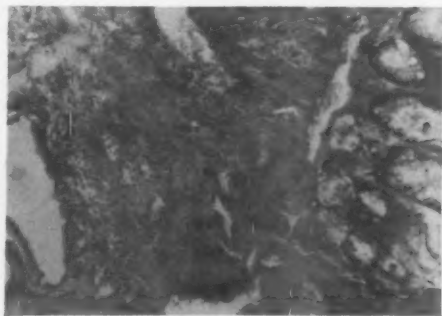


FIG. IVA. Biopsy rectal wall showing intact mucosa (on right) and perivascular infiltration by prostatic adenocarcinoma (on left). Such a deposit might be either missed by a more superficial biopsy or escape notice by the pathologist whose attention is focussed on the rectal mucosa.

Case 5

During the past three years, L.F., aged 78, had been treated by fulguration for a simple papilloma of the anterior wall of the rectum at the level of the prostate. During the last three months there had been severe diarrhoea with some rectal incontinence. The urinary stream was poor and there was some frequency of micturition. Sigmoidoscopy revealed a papilloma on the anterior wall of the rectum

with induration about it, thought to be due to previous diathermy. It was difficult to feel the prostate, but the impression was given that the right lobe was hard and fixed. At 16 cms. there was a malignant papilloma, the biopsy of which was positive. Abdomino-perineal resection of the rectum was performed and difficulty was experienced at the level of the prostate and a shaving of the gland was taken with the rectal wall to effect a separation. There were no post-operative complications.

Examination of the specimen revealed that the lower tumour of the rectum in the prostatic region was an adenocarcinoma of low-grade malignancy. It extended only as far as the submucosa. Invading the muscle of the rectum from the external aspect was a carcinoma of prostatic origin.

A total serum acid phosphatase carried out three weeks post-operatively was normal.

The patient was discharged on 5 mgms. stilboestrol daily, passing urine satisfactorily.

Case 6

In March, 1951, H.S., aged 70, was admitted to a surgical ward with a diagnosis of rectal neoplasm. There was a history of six months' aching pain in the anal region with steadily increasing constipation, loss of one stone in weight and some slowing up of the urinary stream. On inspection of the anal region there was a distinct fullness of its left margin. Rectal examination disclosed a tense elastic swelling filling the left ischio-rectal fossa and bulging freely into the rectal lumen. This mass seemed separate from the prostate, which was small, hard and fixed

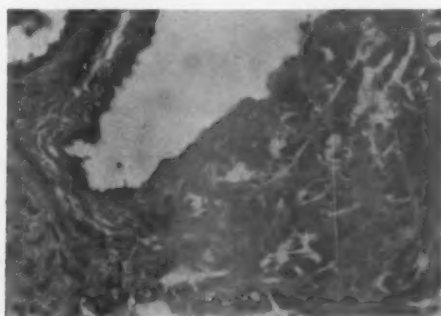


FIG. IVB. High-power view of deposit of prostatic adenocarcinoma in rectal submucosa.

and situated high in the rectum. Several suggestions were made about the nature of the swelling, even to a hydatid origin. Urological investigation was requested, which was undertaken rather unwillingly because it was thought the mass was below the pelvic floor and had no connection with the apparently malignant prostate above it.

The prostatic urethra was sclerosed and there was six ounces of residual urine. The prostatic outline was irregular and appeared typical of a carcinoma of the gland. Bi-manual examination suggested that there might be a communication between the rectal

mass and the prostate passing through the pelvic floor. It seemed feasible to inject the cystic swelling with dye to demonstrate its outline and its ramifications. A urethrogram was done at the same time. The cyst was entered through the rectal wall and about 50 c.c. of clear fluid withdrawn and 10 c.c. of radio-opaque solution injected into the sac. This revealed a larger cystic space below the pelvic diaphragm and above this two smaller cavities apparently in the left lobe of the prostate. In the urethrogram the prostatic urethra was narrowed and somewhat distorted. It did not open out on micturition.



FIG. V. Whole section through growth at lower end of rectum showing part of the low-grade adenocarcinoma of rectum (here *in situ*) and infiltration of the muscle from outside by prostatic adenocarcinoma.

There were no cellular elements or bacterial growth in the fluid aspirated. The serum acid phosphatase was normal and an X-ray of the lumbar spine and pelvic girdle showed no abnormality. A provisional diagnosis was made of carcinoma of the prostate with extension through the pelvic floor to the ischio-rectal fossa and cystic degeneration in the tumour. Transurethral biopsy of the tissue at the bladder neck was done but the sections revealed only dense fibrosis and no malignant change. However, he was placed on a daily dose of 5 mgms. stilboestrol and rapidly began to improve. Urinary function became satisfactory, the cystic mass in the rectum disappeared and the prostate began to assume a more normal outline.

In August, 1953, he was again admitted with a history of severe attacks of haematuria, difficulty with bowel and bladder functions and loss of one stone

in weight. The mass in the ischio-rectal fossa was reforming and the prostate again becoming hard and irregular. The serum acid phosphatase level was slightly raised but there were no secondary deposits in bone. The dose of hormone was doubled and he again began to improve.

In October, 1953, there was loss of bowel control and the large mass bulging into the rectum was incised just external to the anal margin. Almost one pint of blood-stained necrotic material was evacuated and this contained scattered groups of neoplastic cells of uncertain origin. The sinus gradually healed and he was again discharged. At this time the serum acid phosphatase was elevated to 23 units.

In December, 1953, he was readmitted with marked haematuria. His serum acid phosphatase was now 45 Units and tissue from an endoscopic resection of the prostate was suggestive of adenocarcinoma of the gland. The patient's condition slowly deteriorated and in May, 1954, he died, the diagnosis still being in some doubt. At post-mortem examination the pelvic organs were removed in one block and serial horizontal section performed.

Sections of the prostate on microscopy showed a picture suggestive of adenocarcinoma. Also sections from the walls of the cystic spaces showed the same picture of malignancy.

This case is of interest because the tumour had not invaded the rectal wall but had extended through the pelvic floor and occupied the left ischio-rectal fossa and caused considerable bulging into the lumen of the rectum, thus giving rectal symptoms.

It is unusual for prostatic cancer to penetrate the pelvic floor and unusual for the growth to contain large cystic spaces. This threw doubt on the diagnosis and it was thought until the final post-mortem findings that the growth might in fact originate from the seminal vesicle. However, the same groupings of malignant cells were found in the prostate and in the wall of each of the three cystic cavities.

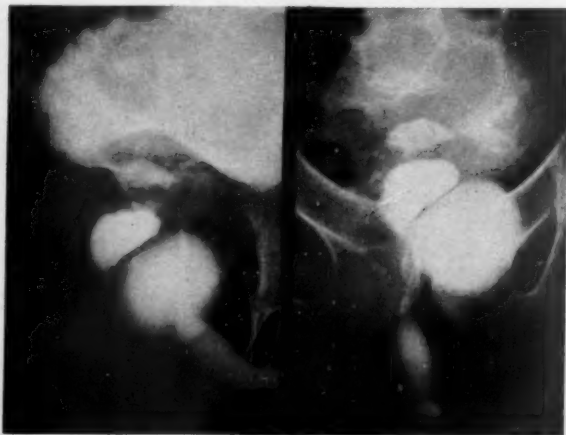
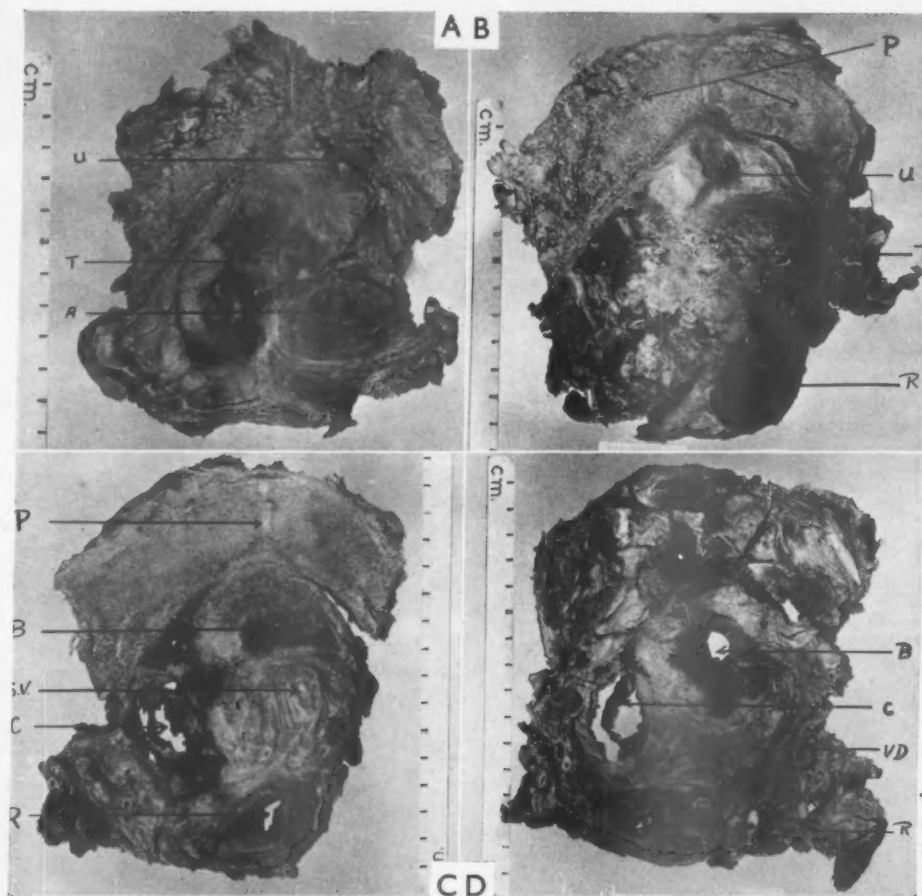


FIG. VI. A.P. and oblique views of injected cystic spaces with combined cysto-urethrogram.



FIGS. VIIA, VIIB, VIIC and VIID. Transverse sections of pelvic contents, viewed from below.

(a) Just above anal margin; (b) $5\frac{1}{2}$ cms. above (a); (c) $1\frac{1}{2}$ cms. above (b);
(d) $1\frac{1}{2}$ cms. above (c).

U.—Urethra.

A.—Anus.

T.—Tumour.

P.—Pubic bones.

R.—Rectum.

B.—Bladder.

V.D.—Vasa-deferentia.

S.V.—Seminal vesicle.

C.—Cystic degeneration of tumour.

DISCUSSION

The first case is the crux of the discussion and it was to draw attention to this dire possibility that this paper was written. Few surgeons today would proceed to a radical removal of the rectum unless they were in possession of a conclusive biopsy of the relevant tissue. A second thought is worth while in these cases: that the tumour may be

of prostatic origin. Even where the rectal mass is bulky and the distortion of the canal pronounced, if the rectal mucosa covering the tumour is relatively intact, further consideration is warranted. Having seen six cases in the last three years which so closely simulated carcinoma of the rectum, one feels there must be cases where on rectal examination a supposed neoplasm of the rectum is

felt, is considered inoperable and a colostomy performed. How much more simple for the patient to have taken a stilboestrol tablet daily and not have the discomfort of a colostomy. In order to avoid making the above errors it is necessary for the surgeon to be aware that carcinoma of the prostate can extend posteriorly through Denonvilliers' fascia and invade the rectal wall and produce rectal symptoms. However, in all our cases, although the rectal symptoms were suggestive of a carcinoma of the rectum, there was no passage of blood or slime per rectum and on rectal examination and proctoscopy the rectal mucosa appeared to be intact and not ulcerated as one would expect with a primary rectal neoplasm. The other important lesson to be learned is that no matter how strong the evidence seems to be in favour of the condition being a carcinoma of the rectum, major

surgery must never be embarked upon until a positive biopsy has been obtained, even if biopsy has to be repeated many times. It is of interest to note that, although in Case 1 the surgeon was sure he was taking the biopsy from the affected part of the rectum, the report showed normal rectal mucosa. If a slightly deeper biopsy had been taken the true picture of the case would have been revealed.

SUMMARY

Six cases have been presented in which there was a primary lesion in the prostate simulating disease of the rectum. In one case the rectum was removed when the lesion was actually in the prostate. In another case there was a double lesion with malignant change in each organ.

ACUTE PHLEGMONOUS CAECITIS

A REPORT OF TWO CASES

By TERENCE W. HORNE

Hobart

ACUTE phlegmonous caecitis is a condition which deserves to be more widely known. This is so for three reasons. First, the disease is, I believe, more common than the small number of case reports in the literature would seem to indicate. Thus, the two cases reported here have been seen within a period of six months and several surgeons I have questioned can recall, in retrospect, cases which almost certainly have been examples of this lesion, but which have not been recognized at the time. Secondly, in its subacute form, the condition may be mistaken for cancer, and unnecessarily severe operations may be performed. Thus, in Tagart's collected series (Tagart, 1953) of 24 cases no less than 7 were subjected to hemicolectomy. Thirdly, the disease has a surprisingly high mortality rate—nearly 20 per cent. in Tagart's series. This should be improved by recognition of the disease at operation, and by better understanding of its natural history. In the case reported by Meyer and Disch (1945) the patient died from spreading peritonitis on the eleventh day after appendicectomy, due to necrosis and abscess formation in the wall of the caecum. Had the frequency of perforation of the lesion been kept in mind, this patient might have been saved by early operative intervention.

The clinical features of the disease have been well described by Tagart, to whose article reference should be made. However, it may be of value to summarize these.

The lesion takes the form of a well-defined indurated and thickened area felt in the wall of the caecum. The peritoneal surface is acutely inflamed, whilst an ulcer crater is often palpable on the mucosal aspect. Microscopical examination shows non-specific acute inflammatory changes only. The lesion may resolve—the commonest course, it may enter on a subacute phase when it most simulates neoplasm, or it may perforate, giving rise to a general peritonitis. The aetiology is unknown.

The symptoms and signs in the majority of cases are indistinguishable from those of acute appendicitis, whilst in the subacute phase when the mass may be palpable, carcinoma is simulated.

The aim of surgery in this condition is either to prevent perforation or treat it if it has already occurred. For these purposes, excision, oversewing, omental patching and exteriorization have all been used. It is said that concurrent appendicectomy does no harm.

Biopsy should be performed in doubtful cases.

CASE REPORTS

Case 1

Mrs. P.D., aged 48, was admitted to the Royal Hobart Hospital on 6th August, 1953, as an "acute abdomen." She gave a history of three days' abdominal pain. The pain was intermittent, of moderate severity, and was felt across the lower abdomen; it tended to be worse on the right side. She had vomited twice shortly after the onset of the pain and her appetite had been poor since. Her bowels had moved on the day of admission, when the motion had been rather loose. There were no urinary symptoms, and she had had the menopause several years previously.

She had been treated in the past for hypertension; had had pneumonia and pleurisy one year before, and more recently had had a course of penicillin for boils which had ceased only ten days before admission.

On examination: The patient was lying comfortably in bed, but turning and moving appeared to cause her pain. The temperature was 98.4°F, the pulse rate 78 per minute, and the respiratory rate 20 per minute. The blood pressure was 240/150 mm. of mercury. No abnormality was found in the urine. The tongue was heavily coated, and the breath was foul.

There was acute tenderness in the right lower quadrant, with rebound tenderness and well developed muscular guarding. There was mild tenderness in the left lower quadrant of the abdomen, and pressure here caused pain referred to the hypogastrium. Bowel sounds were present. There was no abdominal distension. Rectal examination elicited acute tenderness high up on the right side of the pelvis.

Examination of the heart and lungs revealed no abnormality except slight cardiac enlargement consistent with the degree of hypertension present.

A diagnosis of acute appendicitis was made, and immediate operation advised.

Operation: The abdomen was opened by a muscle-splitting incision in the right lower quadrant. The appendix was found to be normal in appearance, but in the lateral wall of the caecum was an indurated area about two inches in diameter and half an inch in thickness. An ulcer could be felt on the mucosal aspect of the centre of the mass. The overlying peritoneum was acutely inflamed, and in addition there was inflammation of the serosal coat of the surrounding gut. No free fluid was present in the peritoneal cavity. The condition was recognized as an acute phlegmonous caecitis, and as there were no signs of impending perforation, the abdomen was closed, with drainage of the subcutaneous tissues only. The appendix was left *in situ*.

Post-operatively, the patient was treated with penicillin (1,000,000 units at once and 500,000 units twice daily), and streptomycin (1.0 gm. at once and 0.5 gm. twice daily).

She made an uneventful recovery. Her temperature was elevated intermittently for the first six days, and thereafter remained normal. Her pain and tenderness gradually subsided, and on the seventh day she was transferred to a convalescent home.

Follow-up: On 14th September, 1953, the patient was well and had no symptoms. On examination there was a slight thickening of the tissues deep to her wound.

A barium enema performed at the time was reported on as follows: "The enema flowed freely to the caecum. There was some spasm and irritability of the caecum consistent with an inflammatory element."

On 5th October, 1953, the patient was very well, but still had slight tenderness in the iliac fossa.

A barium meal and follow through was performed on 26th October. The report was: "The appendix is pelvic in position. No abnormality was seen in this area at present."

On 2nd November, the patient was well except for occasional cramping pains in the upper abdomen. There was no tenderness or induration in the right iliac fossa.

At this stage it appeared that the lesion had completely resolved, and the patient was discharged from the Outpatients' Clinic. She was advised to return at her convenience for appendicectomy, as it was felt that the presence of an incision in the right iliac fossa might conceivably cause confusion if in the future she should develop acute appendicitis.

Case 2

Mr. J.P., aged 26, was admitted to the Royal Hobart Hospital on 13th February, 1954, complaining of abdominal pain of seven hours' duration. He had been quite well until the morning of the day of admission, when he had developed a severe pain in the right lower abdomen. This pain reached its maximum intensity in fifteen to twenty minutes. It later became generalized over the whole abdomen. The pain was not colicky. It was still severe at the time of admission. The patient had vomited once six hours after the onset of the pain. The bowels had been open regularly and there were no urinary symptoms.

There was a history of vague abdominal pain two years previously.

On examination: The patient was a healthy-looking young man who appeared to be in pain.

The temperature was 96°F, the pulse rate 76 per minute, the respiratory rate 18 per minute, and the blood pressure 130/90 mm. of mercury. Examination of the urine revealed no abnormality.

The abdomen exhibited board-like rigidity and marked tenderness on the right side and in the epigastrium, and moved poorly on respiration. There was no distension. Bowel sounds were present. A rectal examination was not performed.

No abnormality was detected in the heart, lungs or central nervous system.

The diagnosis was thought to be either perforated duodenal ulcer or acute appendicitis, the latter being thought more likely. Immediate operation was advised.

First operation (Mr. Bruce Boscence): The abdomen was opened by a muscle-splitting incision in the right lower quadrant.

The serosal coats of the caecum, appendix and terminal ileum were inflamed, and a few small lymph glands were palpable in the ileo-caecal angle. No induration was felt in the caecal wall. No free fluid was present in the peritoneal cavity. A swab on a holder was placed up to the duodenal area and was withdrawn uncontaminated. Appendicectomy was performed without inversion of the appendical stump, and the excised organ slit open. There was no evidence of inflammation in the mucosa. The wound was then closed in layers without drainage. At operation, the exact diagnosis remained in doubt.

Post-operative course: The patient was given penicillin 500,000 units every six hours and streptomycin 0.5 gm. twice daily. He appeared at first to be making an uneventful recovery, and he was free from pain on the third post-operative day, although he had a mild intermittent elevation of temperature. On 17th February he was transferred to a convalescent hospital, feeling quite well. Three days later the patient was readmitted to the Royal Hobart Hospital with further abdominal pain. This pain had started two days previously, was situated in the lower abdomen and radiated also into the perineum. The pain was intermittent and was severe at times.

He had vomited several times on the day of admission. He had been passing frequent small motions. There were no urinary symptoms. At the time of admission, the pain was constant and severe and the patient felt nauseated.

On examination: The patient looked sick and in pain.

The temperature was 101.8°F, the pulse rate 96 per minute and the respiratory rate 24 per minute. There was mild distension in the lower abdomen. The previous operation wound was almost healed although there was some induration present in it. There was marked tenderness in the lower abdomen, with rebound tenderness and muscular guarding. The percussion note in the hypogastrium was hyporesonant. Bowel sounds were present but scanty. On rectal examination, there was marked tenderness in the rectovesical pouch but no mass was palpable.

A provisional diagnosis of general peritonitis was made. The aetiology was doubtful, although a leak through the appendiceal stump was considered as a possibility.

Treatment was at first conservative. Gastric suction and intravenous fluids were begun and penicillin (1,000,000 units at once and 500,000 units six hourly) and streptomycin (1.0 gm. at once and 0.5 gm. six hourly) were recommenced. This regime was continued for two days without deterioration or improvement of the patient's condition.

On the third day after admission the wound in the right iliac fossa was explored but no pus was found. At this stage, the case was carefully reviewed.

The abdominal findings were much the same as on re-admission, except that tenderness was now most marked in the right iliac fossa, and there was a suspicion of a palpable mass there.

Rectal examination now disclosed a tender mass occupying the recto-vesical pouch.

Laparotomy was decided on and performed that evening.

Second operation (T.W.H.): The abdomen was opened through a right lower paramedian incision, the layers of the abdominal wall being found to be quite oedematous. The omentum was found to be oedematous and inflamed, and was lying in the hypogastrium and right iliac fossa.

Gentle displacement of this revealed coils of the lower ileum, thickened and oedematous, bound together and in places sharply kinked by the acute inflammatory adhesions of a general peritonitis. Separation of the loops disclosed several pockets of pus, the largest of which was in the pelvis. These were evacuated with a sucker. The caecum was next inspected. The appendical stump was found to be intact, but about half an inch posterior and lateral to it, a small perforation of the caecum was found, verified by passing an artery forceps through it into the colon. The perforation was in the centre

of an indurated area about two inches in diameter in the postero-inferior aspect of the caecal wall and corresponded to an ulcer palpable on the mucosal aspect. The whole caecum and surrounding parietal peritoneum was thickened and oedematous.

A diagnosis of an acute phlegmonous caecitis with perforation was made.

The perforation was closed by sutures and a free omental graft and a corrugated rubber drain placed down to the caecum through a stab wound.

To divert the faecal stream from the site of perforation, and also because the kinked terminal ileum seemed a potential site of obstruction, an ileo-transverse colostomy was performed. As the loop of ileum used in the anastomosis was very oedematous, the integrity of the anastomosis was safeguarded by passing a large-bore rubber catheter through an opening in the transverse colon, where it was fixed by a double purse-string suture of chromicized catgut, through the stoma and about six inches up the afferent ileal loop. The catheter was brought out through the upper end of the wound and later connected to a bottle.

The wound was closed in layers.

Post-operative course: Gastric suction and intravenous fluids were continued. Intravenous terramycin was given through the drip (500 mgm. in the first bottle of fluid and subsequently 250 mgm. six hourly).

The patient's recovery was most gratifying. The temperature fell to normal on the 25th and remained so. Oral feeding was begun on the 25th, and on the 26th, the intravenous drip was discontinued and the terramycin given by mouth (500 mgm. six hourly). The drain was removed also on the third day. The catheter was removed on the fifth day, the bowels having opened normally.

On 4th March, the patient was transferred back to the convalescent hospital with all wounds clean and nearly healed.

Follow-up: 3rd May, 1954. The patient felt well and had no symptoms except occasional slight pains in the right lower quadrant. His bowels were regular and there was only one motion a day. On examination, the wounds were well healed. There was slight tenderness in the right lower quadrant, but no mass or induration palpable.

31st May. The patient felt very well and had no symptoms. Very slight tenderness was present in the right lower quadrant.

9th June. Barium clyisma was performed and the report read: "Clyisma shows clearly the ileo-transverse colostomy and the partly-filled caecum still distorted."

21st June. The patient was still very well and symptom free. Very slight tenderness could still be elicited.

COMMENT

Case 1 illustrates the usual course of the disease, where complete resolution has apparently occurred. The decision not to remove the appendix at operation was probably unnecessarily cautious.

Case 2 is of interest as it demonstrates the earlier stages of the disease, and the way in which the lesion may subsequently proceed to perforation. The method of dealing with the perforation—namely, closure of the perforation by suture and free omental graft plus ileo-transverse colostomy—does not appear to have been previously described. Exteriorization of the caecum in this case would have been technically difficult if not impossible.

SUMMARY

Acute phlegmonous caecitis is probably more common than is generally realized. It is a localized inflammatory process in the

caecal wall. The symptoms and signs are identical to those of acute appendicitis, or less often, carcinoma of the caecum. The aim of surgery is to prevent or treat perforation. Reports of two new cases are given.

ACKNOWLEDGEMENTS

I wish to express my gratitude to Mr. T. Giblin and Mr. J. B. G. Muir for having allowed me to operate on the cases which were under their care. I am indebted to Mr. B. Boscence for the description of the findings at the first operation in Case 2. My special thanks are due to Mr. Muir for his helpful advice and criticism in the preparation of this paper.

REFERENCES

- MEYER, L. M. and DISCH, R. (1945), *Amer. J. Surg.*, vol. 68, page 394.
TAGART, R. E. B. (1953), *Brit. J. Surg.*, vol. 40, page 437.

THE LATERAL SPREAD OF CARCINOMA OF THE RECTUM

By J. FREIDIN

Department of Pathology, University of Melbourne

THE investigations of Miles (1910) into the spread of carcinoma of the rectum established the three directions of lymphatic spread commonly referred to by various writers since his original work, namely, upward lymphatic spread along the superior rectal vessels, downwards below the level of the tumour also along the course of these vessels and, finally, laterally along another set of vessels, the lateral rectal vessels, draining to the iliac chain.

Over a period of many years, the work of Dukes (1943) and his co-workers has greatly clarified the position with regard to upward and downward lymphatic spread. They have attempted to correlate numerous factors, such as the surface extent, protuberance or depth of ulceration, and the depth of infiltration of the primary tumour, its histological grading and the number and position of lymph node metastases, with the survival rates in reference to five and ten year periods.

As a result of this accumulated experience it has been found that low-lying rectal tumours have a poorer prognosis than those situated in the rectum above the peritoneal reflection and it has been suggested that this is due to the opportunity for an additional direction of spread laterally, and it is this factor which worsens the prognosis.

It is the purpose of this report to elucidate this question of lateral lymphatic spread and to demonstrate its significance in the surgical approach to carcinoma of the rectum.

REVIEW OF THE LITERATURE

This review is directed to show: first, what evidence exists to show that the level of the tumour has any influence on the prognosis of the patient, and secondly, what work has been done elsewhere to explain any variations in prognosis that have been observed.

(1) *Effect of level on prognosis*

Lockhart-Mummery (1926) and Coffey (1931) both stated that, in their opinion,

lesions of the recto-sigmoid had a better prognosis than those of the rectum itself.

Dukes (1943) stated that in cases of carcinoma of the rectum without nodal involvement, the location of the lesion had no effect on the five-year survival rate. Where there were nodal metastases, the results "varied to some extent with the position in the rectum of the malignant growth." He considered that lesions in the mid-rectum did less well than those in the upper and lower parts of the rectum and that this was due to the lateral spread in the mid-rectum. No pathological data was provided for this view, whereas numerous dissections had been prepared by him to demonstrate spread into nodes upwards along the superior haemorrhoidal vessels.

Important work was done by Gilchrist and David (1947 and 1948). They considered 200 patients with carcinoma of the large bowel who had undergone abdomino-perineal resection of the rectum; they excluded all palliative resections with known metastases left in the body and followed their cases for five years. They divided their neoplasms of the rectum into an extraperitoneal group, these being partially or completely below the peritoneal reflection, and into an intraperitoneal group, which included the lesions arising in a part of the bowel entirely covered by peritoneum anteriorly.

They obtained their data from examination of the operative specimens. Their results show that, in the intraperitoneal group, 50 per cent. of cases with metastases were alive after five years and 90 per cent. of cases without such nodal metastases were alive after the same period. In the extraperitoneal group 37.5 per cent. of cases with nodal metastases were alive five years after operation and 74.4 per cent. of cases free of metastases had a five-year survival rate.

They noted particularly that in this series of cases, the extraperitoneal group, with nodal metastases, showed 23.2 per cent. of

local recurrences whereas the local recurrence rate was 4.6 per cent. for cases free of metastases. However in the intraperitoneal group the local recurrence rate was only 3.6 per cent. overall.

This work showed the poorer prognosis that is attached to low-lying rectal tumours and this applied particularly to cases with demonstrable lymph node metastases.

Waugh and Kirklin (1949) again consider the importance of the effect of the level of the primary tumour on the prognosis. They point out the value of such investigations, since the conclusions would help in the comparison of the follow-up of the results that may be published, when a writer is advocating any one of several operative techniques such as abdomino-perineal resection, posterior resection or pull-through operations; the known importance of the level on prognosis would eliminate this variable factor from the different results obtained.

To study this factor, they considered cases of abdomino-perineal resection for adenocarcinoma of the rectum and sigmoid, who survived operation, and excluded palliative resections. Three hundred and eighty-eight cases were studied. They determined the level of the lesion as the distance found on sigmoidoscopy from the lower level of the lesion to the anal margin. They considered this the best method of measurement since it could readily be assessed during life and help in pre-operative prognosis.

Of cases without nodal metastases, lesions, considered to be 0-5, 6-10, 11+ cm. respectively above the anal margin, have five-year rates of 66 per cent., 75.5 per cent. and 68.1 per cent. respectively. Of cases with nodal metastases, the survival rates for corresponding levels are 23.3 per cent., 25 per cent. and 33 per cent.

They re-analyze their cases and consider cases with similar grading on histological examination — grade 2 (Broder's classification) — in order to eliminate this variable factor from their results. The five-year survival rates for the three level subdivisions mentioned above, are 61.1 per cent., 74.5 per cent and 75 per cent. for cases without nodal metastases and 26.7 per cent., 29.4 per cent. and 43.5 per cent. for cases with such involvement.

In considering these results which show the poorer prognosis in low-lying lesions they point out that lesions at different levels in the rectum show much the same distribution in histological grading; that venous involvement, when present, occurs with equal frequency at all levels; that the Dukes' (1943) classification is not a factor, since only cases with nodal involvement show sharp differences in prognosis; and that the position of the peritoneal reflection itself is not important, as it has been shown by Kirklin, Dockerty and Waugh (1949) that the relation of the growth to this variable point does not affect the prognosis.

The conclusion to be drawn from published reports is that the lesions situated in the lower part of the rectum have a poorer prognosis than the high ones, and this factor of level influencing prognosis is particularly brought out in a series which shows lymph node metastases.

It will have been seen already that different authors indicate the level of the rectal cancer in different ways, namely, by direct measurement from the anal margin on a fresh or preserved specimen, by measuring the distance from the anal margin using the sigmoidoscope during life, or by relation of the growth to the peritoneal reflection.

Kirklin, Dockerty and Waugh (1949) examined this last point carefully; using combined excision specimens of uniform grade 2 (Broder's histological grading) and, excluding palliative resections, they divided their specimens into those which were clearly above or below the peritoneal reflection and discarded all lesions partly above or below this reflection. They then pointed out that the peritoneal reflection varies greatly round the rectum (Fig. 1) and that the anterior point of reflection is higher in males than females. In their investigation they selected the lateral point of reflection as the arbitrary level of reflection to obtain uniformity: they found that this point varied from 5 to 10 cm. from the anal margin.

They found that the five-year survival rate for lesions above the peritoneal reflection was 54.4 per cent., and for lesions below it was 59.4 per cent. They concluded that the relation of the tumour to the peritoneal reflection, *per se*, does not influence prognosis. On

further analysis, they showed in their series that lesions between 5-7cm. above the anal margin had a survival rate of 43.8 per cent. compared with the values of 54.4 per cent. and 59.4 per cent. for lesions situated unequivocally above and below the peritoneal reflection respectively. This is a significant finding since it correlates with the levels of distribution of lateral rectal vessels which were found in the series of cases to be presented here.

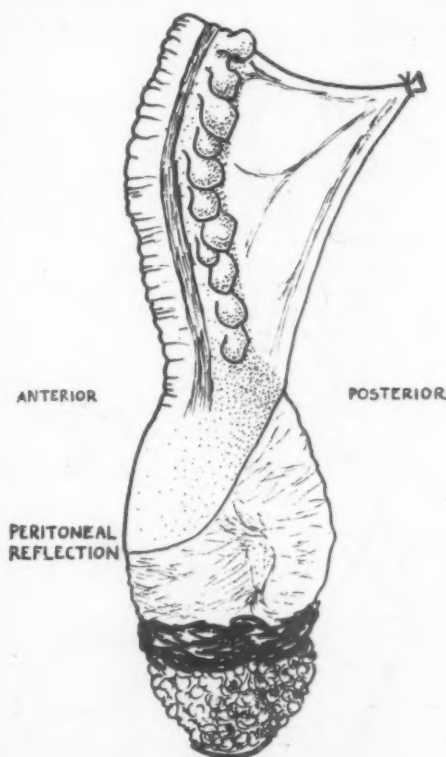


FIG. 1. Drawing showing lateral view of resected specimen of rectum and sigmoid colon. Note the difference in level of the peritoneal reflection around the rectum.

(2) Evidence produced to explain the effect of level on prognosis

The most important work has been carried out by Guernsey *et alii* (1951). They used specimens obtained by combined resection and determined levels by measurement from the lower border of the lesion to the dentate

margin. Subdividing the series into three groups of levels, namely, 0-2 cm., 2.5-6 cm. and 6-15 cm. above the anal margin, they found that the five-year survival rates were 76 per cent., 84 per cent. and 85 per cent. respectively for cases free of nodal metastases and 31 per cent., 36 per cent. and 40 per cent. respectively for cases showing such involvement.

They re-examined a large number of the specimens and subjected to histological examination parts of the levatores ani and accompanying structures either as a routine matter or to include suspicious areas. They found not one instance of involvement along the levator or its fascia or its lymphatics; there was no evidence of involvement of the deep or superficial external sphincters; the internal sphincter was involved in a number of cases by direct extension.

They conclude that the prognosis for carcinoma decreases the nearer the lesion is to the levator ani but state that "although it is assumed by most investigators that the poorer prognosis of these low-lying lesions is due to the extension of the carcinoma along the lateral zone of spread over the levator ani, no instance of such spread was found in this study . . ." They further state that "it is probable that necropsy study, in which all the tissue in the lateral zone of spread to the pelvic wall is available would be necessary for a complete and accurate investigation of the problem."

Similar work was performed by Wood and Wilkie (1933) who made numerous sections of the levator ani and external anal sphincters but found no cases with metastases in them. Grinnel (1942) found one case of lateral spread in a specimen where there was complete upward blockage by metastases in lymph nodes. Gordon-Watson and Dukes (1930) found evidence of spread along the surface of the levator in one instance in 100 specimens.

PRINCIPLE OF PRESENT INVESTIGATION

The review of the literature shows that there is a worse prognosis for low-lying neoplasms of the rectum following abdominoperineal resection. However, there is very little data available to demonstrate the responsible factor at work, the general view

being that spread along the lateral rectal vessels must occur although it cannot readily be demonstrated.

In attacking this problem, it appeared natural to apply the same method of investigation to the lateral vessel zone of spread that Dukes and his co-workers had applied to the superior haemorrhoidal vessels with such fruitful results, namely, careful dissection of these vessels out of their surrounding fibro-fatty tissue accompanied by a careful search for related lymph nodes and their histological examination. This method of investigation is considered to be superior to that of subjecting to histological section various pieces of levator ani and surrounding tissue that may be considered to be suspicious macroscopically or, where no such suspicious areas of malignant involvement are to be seen, hoped to be representative. Such pieces of material may not bear any relation to the lateral rectal vessels, as they may have been taken from quadrants other than the right and left lateral ones. Furthermore, as muscle fibres are often torn, split or attenuated during the perineal dissection when the rectum is forcibly pulled upon, and as these muscle fibres contract and bunch up toward the lower end of the specimen, this leaves an area of only mucosa and circular coat between this lower muscular mass and the pararectal fat which contains the lateral and superior haemorrhoidal vessels. This lower muscle mass consists of cut levator ani fibres and the torn longitudinal fibres of the rectum; a section taken from this mass is consequently much lower on the specimen than the region of the lateral vessels in which one is interested (Fig. II).

Since upward spread consists so regularly of discrete metastases in lymph nodes without intervening permeation of lymphatic channels and, less commonly, of direct involvement of a vein emerging from the tumour mass, it appears obvious that lateral spread must also occur in the same manner, namely, to discrete lymph nodes placed along the lateral haemorrhoidal vessels or by permeation of the lateral vein. Haphazard infiltration of fibro-fatty tissue by clumps of neoplastic cells is not seen in upward spread except in very large tumours which have encircled the rectum. These are subject to deep excavation and deep infiltration right

through the pararectal fat and the infiltration is seen only in close relation to the primary tumour mass. There is no reason, from observations made, to suppose that neoplastic cells will be found growing at a distance along the fascial sheath of the levatores ani or be deposited among the fat surrounding the lateral vessels except in discrete lymph nodes. Since such nodes may be of small size and few in number, one is relying purely on chance, if one is looking for evidence of lateral spread, by taking blocks of tissue from suspected areas in the region of the levatores.

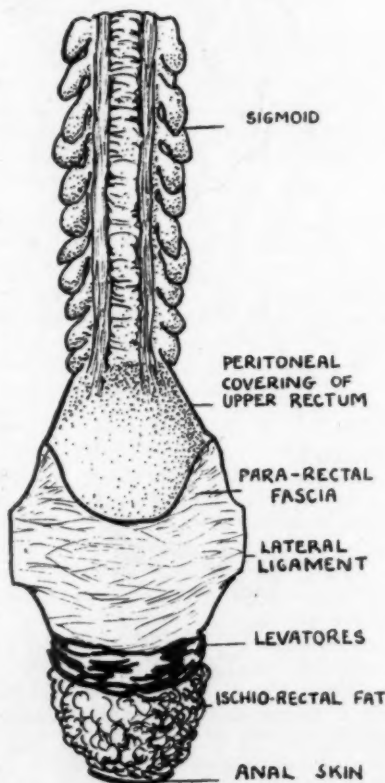


FIG. II. Drawing showing anterior aspect of resected specimen of rectum and sigmoid colon. Note the lateral ligaments enveloped in pararectal fascia.

On examination of a specimen of rectum and sigmoid colon obtained by abdominoperineal dissection, the following points emerge:

- (1) The lower part of the rectum is surrounded by a collar of muscle representing the divided and contracted levators.
- (2) Below this, between the muscle and the perianal skin is a mass of fat with coarse lobules and no evidence of encapsulation since it has been obtained by incision into the ischio-rectal fossae and it is "ischio-rectal fat."

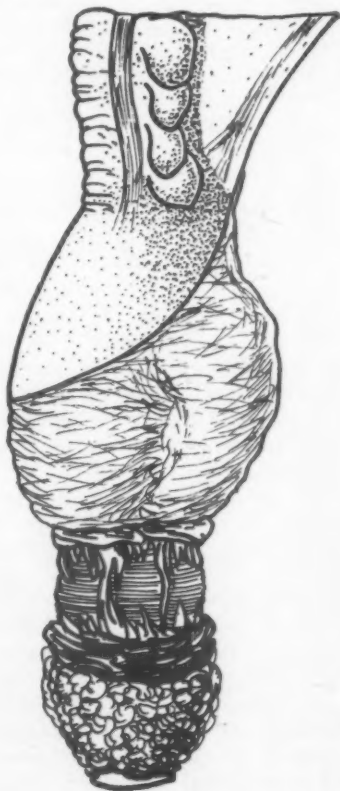


FIG. III. Drawing showing lateral aspect of rectum. The levatores and longitudinal muscular coat of the rectum have been torn during the resection revealing the inner circular coat. Note the high position of the lateral ligament invested by tough pararectal fascia.

- (3) A zone of fat is observed between the collar of muscle and the peritoneal reflection. This zone extends highest at the back since the reflection ascends

from its lowest anterior point, in the pouch of Douglas, to become the site of meso-sigmoid (Fig. III).

This fat, the true pararectal fat, cannot be seen until a thick fibro-areolar layer has been removed from the specimen. This is the pararectal fascia, a definite layer which is readily outlined during the abdominal dissection once the superior haemorrhoidal vessels have been defined in the meso-sigmoid area and the hand is carried down in front of the sacrum, thus pushing anteriorly the pararectal fascia, the pararectal fat with its contained vessels and the rectum itself.

When a fresh specimen is examined it is seen that between the peritoneal reflection and the levator muscle mass there are some horizontally placed fibres in the pararectal fascia. These extend both in front of and behind the rectum and are seen to stop abruptly laterally: they have been cut during the resection and represent the fascial investment around the lateral rectal vessels and accompanying fat. When, as mentioned previously, there has been a tear in the longitudinal rectal muscle and the levator muscle mass has contracted and taken up a low position, the lateral fibro-fatty bundle remains high with the main mass of pararectal fat, due to the strength of the investing pararectal fascia which is in direct continuity with its two funnel-like lateral extensions.

It is obvious therefore that if one is looking for lateral nodal spread it is imperative to know the exact position of the lateral vascular bundle. In the initial part of this series of 100 specimens the surgeon, performing the perineal part of the synchronous resection, used to place a tie on what he considered to be the lateral "ligament" to lead to the lateral vessels in the later dissection. This ligament was defined by the surgeon as that mass of fibro-fatty tissue which held the rectum in the pelvis after the peritoneum and superior vessels above, and the levators below, had been thoroughly divided; it was situated laterally on either side, could be hooked down by a finger (Fig. IV) and, if divided before clamping, would produce bright bleeding, though this could vary greatly in degree in different cases. As time went on, it became possible to find the lateral ligament readily in the specimen from

the appearances described above and the step of placing a tie on it during the operation was then omitted.



FIG. IV. Drawing of a phase of the perineal dissection during abdomino-perineal resection of the rectum, to display the left lateral ligament about to be divided.

Of great interest during the operation was the frequency with which the tissue, considered to be the lateral ligament, could be divided without clamping and without any bleeding occurring from its pelvic end. This was observed repeatedly during the course of many resections; unfortunately a record of which cases did and which did not show bleeding on division of the ligament was not kept, but it is felt that this point is important and could be correlated with the frequency of absent or very small lateral vessels found in the dissection of the pathological specimens.

MATERIAL AND METHOD

The material consists of 100 specimens of carcinoma of the rectum and sigmoid colon obtained by synchronous abdomino-perineal resection. They include cases which were known to be palliative, in view of liver metastases, but these were included as the aim here is to show the frequency of lateral vessel type of spread rather than the five-year follow-up which has been done adequately elsewhere. In 78 cases the author was present or assisting at the perineal part of

the operation. In the first 20 specimens ties had been placed on the lateral ligaments by the perineal surgeon. In the remainder, the lateral ligaments were identified by their fascial investment, or in those cases where the tumour was large and in the vicinity of the ligament and had so expanded that the ligament was not recognizable, identification was dependent on finding the vessels themselves. This will be discussed further.

Every specimen was fully opened by a midline incision anteriorly. In many cases this cut across the tumour, but this procedure made the position of superior and lateral vessels constant for subsequent dissection throughout the series. Each specimen was tied to a frame to form a flat rectangle and preserved in 10 per cent. formalin till dissection could be undertaken.

It soon became apparent that lateral vessels were small in many cases and could be readily missed if the fat of the lateral ligament alone were dissected; therefore, in every case, the whole of the superior haemorrhoidal system of vessels with related lymph nodes was dissected. In this way, after the "superior" lymph nodes had been removed, all the related fat could be cleared from the specimen. As the dissection was carried down, there remained a zone of 1-2 inches of pararectal fat above the levators which was known to contain the lateral vessels; particular attention was paid to these lateral fields. In some cases vessels were found in these lateral ligaments. For vessels to be classified definitely as lateral haemorrhoidal arteries and veins the following criteria were used; these vessels were quite separate from the superior haemorrhoidal chain, in that when the superior vessels were traced to their smallest subdivisions into the rectal wall proper, these "lateral" vessels, no matter how small they might be, remained as separate entities. Further additional proof was obtained, for designating a vessel as one of the lateral system, if two or three small vessels in the lateral ligament joined together to form a major trunk which had been cut off sharply (as it would be during the course of the resection) and which again had no communication with the superior chain of vessels (Fig. VII).

All these vessels, both superior and lateral, were carefully charted as the dissection proceeded. Lymph nodes were found regularly, though in varying number, along the superior chain and their position marked precisely on the chart, numbered and subjected to histological section; these were stained with haematoxylin and eosin.

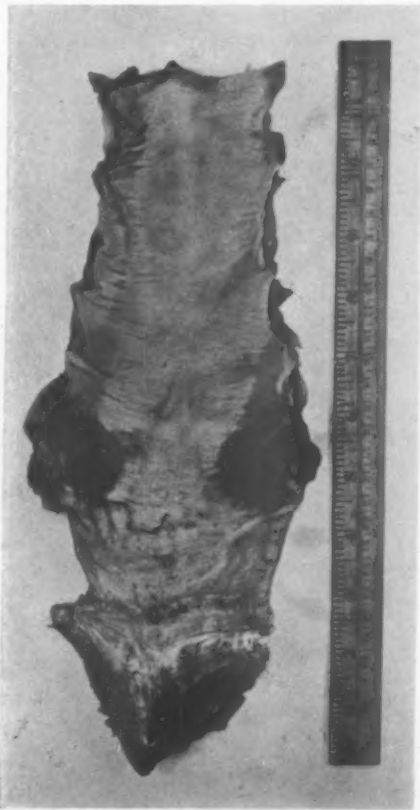


FIG. V. Photograph of specimen of rectum laid open by an anterior midline incision which has bisected a neoplastic ulcer. It is an anterior ulcer which encroaches on both lateral walls and is situated at the level of the lateral fields.

Lymph nodes were looked for in relation to the lateral vessels and, if present, charted and sectioned in the same way.

In a number of specimens no lateral vessel could be found, although the lateral ligament

was either well developed or readily identifiable by its fascial investment; in some instances a vessel, which was a branch of the superior chain, was found to course through the base of the cone-shaped lateral ligament. It is possible that vessels of microscopic size were present in such ligaments; however if none was seen to the naked eye but a lymph node found in this ligament in relation to the superior vessel coursing through its base, then that lymph node was considered to belong to the upward chain and, if involved by metastasis, to be evidence of upward spread.

There remained a number of cases where no lateral vessel could be found but where the tumour, though small, was deeply infiltrating, forming a cone-shaped mass on the back of the specimen. In such cases, where this tumour corresponded in position to the lateral ligament of the opposite side, such infiltration was taken to signify direct involvement of that ligament. Such a state of affairs was, in any case, usually evident during the course of the resection, as the tumour mass was adherent to the lateral pelvic wall and had caused difficulty in resection. From these observations it will be obvious that lateral spread has been considered to be present only where the evidence was irrefutable; the results to be presented should therefore be superior to any obtained by mere block-sectioning of suspicious areas.

RESULTS

One hundred and four specimens were obtained by abdomino-perineal resection. The series was unselected, consisting of cases from public hospitals and private cases from a number of different surgeons as the material became available. Four specimens were discarded since they were the site of conditions other than carcinoma.

The ages of the patients in the remaining 100 cases ranged from 21 to 79 years. The sex distribution was female 46 per cent., male 54 per cent.

The types of primary neoplasm consisted of the usual forms commonly recognized, namely, protruberant (14 per cent.), protruberant with some surface ulceration (8 per cent.), ulcerating with elevated everted edges (42 per cent.), sharply ulcerating without

everted edges but deeply infiltrating (36 per cent.), any of which might have small or extensive surface involvement of the rectal mucosa.

Using the Dukes classification which depends on evidence for the superior zone of spread, the series fell into the following groups:

- (A) where the mucosa alone is involved, 5 per cent.;
- (B) where the muscle is involved, 30 per cent.;
- (Ci) where nodes are also involved close to the primary tumour, 27 per cent.;
- and
- (Cii) where nodes are involved right up to the tie on the superior haemorrhoidal artery, 38 per cent.

The high incidence (65 per cent.) of cases in Ci and Cii showing advanced spread along the superior zone can be correlated with the large number of resections (15 per cent.) which were considered at operation to be palliative and with the increasing trend to perform a resection, despite advanced local disease or metastases, in order to relieve pain and discomfort.

Turning now to the details of the dissections discussed in a previous section, the following results were demonstrated:

- (1) The level of the peritoneal reflection varied greatly in the series. Taking the point of anterior reflection, it ranged from 5 cm. to 12 cm. above the anal margin. Taking the lateral point of reflection on the right and left lateral aspects of the rectal wall, it ranged from 6 cm. to 14 cm. above the anal margin.
- (2) Where lateral vessels were found, they occurred in a more constant position than the peritoneal reflection; their level ranged from 4 to 8 cm. above the anal margin and they were distributed over an area of rectal wall of one to 3 sq. cm. on one or other, or both, lateral walls of the rectum. No constant relation in level was found between the site of entry of the lateral vessels on the one hand and the situation of the levators and the peritoneal reflection on the other. In

other words these 3 levels are independent entities, so that subdivision of neoplasms into supra- and infra-peritoneal groups or into groups dependent on the proximity of the tumour to the levators is, in either case, a fallacious concept since such subdivision may not coincide with the lateral fields (Fig. VI). Nothing short of dissection of the vessels themselves will demonstrate the true picture with regard to this zone of spread.



FIG. VI. Photograph of posterior aspect of specimen of rectum shown in Fig. V. The superior and lateral rectal vessels are displayed (a black background has been introduced between the vessels and the rectal wall). Note the lymph nodes related to the right lateral vessels.

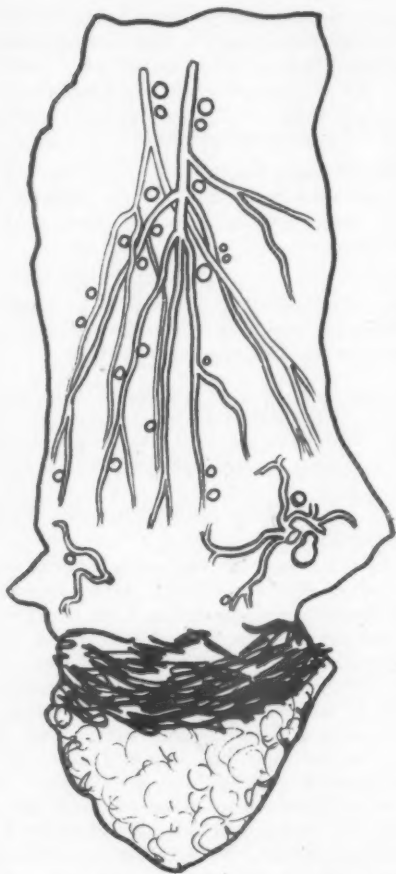


FIG. VII. Drawing showing the distribution of superior and lateral vessels of specimen shown in Fig. VI, with the lymph nodes related to these vessels.

- (3) The cases were subdivided into three groups. The first included those where the primary tumour was considered to be close to the site of entry of the lateral vessels, that is to say, where the vessels were seen to emerge from within an area, which, macroscopically, was involved by the neoplasm. Such a position is presumed to give the readiest opportunity for lateral spread. Where such a neoplasm was small, the vessels on one side only might be seen to emerge from the area of tumour—the rest of

the circumference of the rectum consisting of normal mucosa. In some cases in this group there was deep infiltration of the tumour with invasion of the pararectal fat, so that no dissection of vessels, either superior or lateral, was possible; this state of affairs however, was accepted as indicating indubitable lateral spread.

The other two groups included cases where the tumour was clearly above or below the fields where lateral vessels were found on dissection.

Difficulty was encountered in deciding into which group to place a specimen when, on meticulous dissection, no lateral vessels at all could be found after the superior rectal vessels had been fully traced to their termination in the muscular coats of the rectum. From the experience gained with dissections where lateral vessels had been demonstrated, and considering the range of distance from the anal margin over which they were usually found, it was concluded that tumours whose upper limit was 4 cm. above the anal margin were below the lateral zone field, those which lay between 4 cm. and 8 cm. were within the limit of the lateral zone and those whose lower limit was 8 cm. above the anal margin were above the lateral vessel field.

Group I: Tumours lying in proximity to lateral vessel fields

There were 48 tumours at the level of the lateral zone. Five were situated in the midline, anteriorly or posteriorly, and did not encroach on the lateral vessel fields; 18 were small in surface extent but lay over one or other lateral vessel field; 25 were of such surface extent that they either surrounded the rectal wall at this level or encroached on both lateral fields.

(a) Five midline tumours

Bilateral vessels were found in 3 cases, with a lymph node free of metastasis in one case. Unilateral vessels were found in one case without related lymph nodes.

(b) Eighteen laterally placed tumours

Bilateral vessels were found in 3 cases, one of which had no related nodes; another had nodes free of neoplasm and another had nodes involved by metastases.

Unilateral vessels were found in 8 cases, half of which were detected on the side opposite to that of the tumour; of the 4 cases where the vessels were on the same side as the tumour, only one case showed related lymph nodes and these were free of metastasis. In the 4 cases with contralateral vessels, one showed nodes again free of metastasis.

In 7 cases no lateral vessels at all could be found.

(c) Twenty-five circumferential tumours

Lateral vessels were absent in 6 cases. Unilateral vessels were found in 8 cases and bilateral vessels in 11.

In the 11 bilateral cases, no lymph node was found in 2; 6 had nodes on both sides and 3 had nodes on one side. Of the 6 with bilateral nodes, bilateral metastases were found in 4 and unilateral involvement in 2.

Of the 3 with unilateral nodes, 2 were found to contain tumour deposits and one was free.

In the 8 cases with lateral vessels on one side, no related nodes were found in 4; the other 4 had nodes but only one showed involvement by metastasis.

Thus in 48 tumours at this level, lateral vessels on one or both sides were demonstrated in 34 cases. The overall number of related nodes (one or both sides) was 18. In these, metastatic deposits were demonstrated in 10 cases.

It is interesting to analyze these 10 cases to see if lateral spread had occurred only when the superior zone of spread had become blocked by metastases in lymph nodes: 2 were in Dukes' Class B, 5 in Class Ci and 3 in Class Cii. It is thus evident that lateral spread can occur along the lateral rectal vessels even when the superior route of spread is free or only involved by a few metastases.

Group II: Tumours lying below the level of the lateral fields

This was a group of 13 cases, 5 of which were squamous neoplasms. Since it is known that they spread upwards via lymph nodes, as the adenocarcinomata do, there is no reason to exclude them from this series.

Three tumours were circumferential. One showed bilateral vessels but no related nodes. Five tumours occurred on one or other lateral wall; two of these showed vessels and one of them had nodes on one side and these were affected by malignant deposits.

Five tumours were in the midline; two had lateral vessels and one of these had lymph nodes with unilateral involvement by metastases.

Thus vessels were found in 5 out of 13 cases. The overall incidence of nodes related to these vessels was 2. Both showed involvement by neoplasm.

These 2 cases were squamous neoplasms and were classed as B and Ci respectively, again demonstrating that lateral spread can occur without upward lymphatic blockage.

Group III: Tumours lying above the lateral vessel fields

There was a total number of 39 tumours in this group. Twenty-eight cases were circumferential, and 11 involved one other side of the rectum or low sigmoid.

(a) Twenty-eight circumferential tumours

In 12 tumours no vessel at all was found. In 9 cases bilateral vessels were found and only one of these had related lymph nodes and these were free from involvement. In 7 cases vessels were found in one lateral field; 3 of these had related lymph nodes and none was involved by neoplasm.

(b) Eleven laterally placed tumours

In 4 cases of this group there was no lateral vessel. In 5 cases vessels were found on the same side as the tumour but lymph nodes were not associated with them. In one case, lateral vessels were found on the opposite side of the rectal wall but again there was no related node. Finally one case had bilateral vessels, again no node being demonstrable.

Thus of the total number of 39 tumours situated above the lateral vessel fields, lateral vessels, on one or other side, were demonstrated in 23 cases. Nodes related to these vessels were shown in 4 cases and all were free of malignant deposits. It is seen that in this group, although the tumour is above the lateral vessel fields, these vessels can be

demonstrated in 23 out of 39 cases, in comparison with their presence in 34 out of 48 cases where the tumour is at the lateral field level itself. However, the number of nodes in the higher level group is only 4 in comparison with 18 found in the lower group. It has been demonstrated by King and MacCallum (1940) that "lymph nodes which drain an area in which there is inflammation or new growth are more apparent and more numerous than in normal circumstances" and this may well account for the greater number of nodes along lateral vessels when they are closely related to the tumour.

In all three groups, one finds that the incidence of lateral vessels falls short of the total number of specimens examined. This can be correlated with the site of entry of the superior vessel branches into the rectal wall. This is frequently as low as the lateral vessels and, in such circumstances, the superior haemorrhoidal artery and veins may completely replace the lateral vessels. Furthermore, this observation can be correlated with the lack of bleeding from the cut ends of the lateral ligaments during the abdomino-perineal resection.

SUMMARY

1. A review of the literature demonstrates the slightly poorer prognosis attached to low-lying rectal neoplasms, following abdomino-perineal resection of the rectum.
2. The explanation given by most authors for this observation is that these tumours can spread via the lateral vessel route of lymphatics as well as the well-recognized superior route.
3. Former attempts to demonstrate this route have either been unsuccessful or have produced evidence of lateral spread only in tumours showing complete upward lymphatic blockade by metastases.
4. A series of 100 specimens, subjected to dissection especially for superior and lateral vessels, is presented.
5. The difficulties encountered are discussed; only irrefutable evidence for lateral lymph node spread is accepted.

6. The specimens are divided into three groups according to their level in relation to the lateral vessel fields of spread.
7. Thirteen tumours are below the lateral fields. Five show lateral vessels and 2 of these have related lymph nodes involved by neoplasm.

Forty-eight tumours are situated at the lateral field level with lateral vessels in 34 and lymph nodes related to them in 18, 10 of which are involved by neoplasm.

In these two groups, lateral spread is shown to occur despite a superior avenue of spread which is either free of metastases or contains only a small number of them. This contradicts the opinion expressed by all authors that lateral spread occurs only when the superior zone is blocked by metastases.

In the third group of tumours situated above the lateral fields, 23 out of 39 tumours show lateral vessels, but only 4 have related lymph nodes, none of which is affected by malignancy.

8. Lateral spread of carcinoma of the rectum, via lymph nodes along the lateral rectal vessels, has been demonstrated. It occurs when the tumour is situated either below or at the level of the primary neoplasm and may be present when the superior route of spread is still uninvolved.

ACKNOWLEDGEMENTS

I wish to thank the staffs of the Royal Melbourne and Prince Henry's Hospitals for permission to use the specimens obtained from abdomino-perineal resections. I also owe my thanks to the co-operation of many surgeons who have made specimens available to me from their cases in private practice. Mr. John Turner gave special assistance and encouragement.

This investigation was carried out whilst holding a grant from the Anti-Cancer Council of Victoria.

REFERENCES

- COFFEY, R. C. (1931), *Amer. J. Surg.*, vol. 14, page 161.
 DUKES, C. (1943), *Proc. R. Soc. Med.*, vol. 37, page 131.

- GILCHRIST, R. K. and DAVID, V. C. (1947), *Ann. Surg.*, vol. 126, page 421.
- (1948), *Surg. Gynec. Obstet.*, vol. 86, page 359.
- GORDON-WATSON, C. and DUKES, C. (1930), *Brit. J. Surg.*, vol. 17, page 643.
- GRINNEL, R. S. (1942), *Ann. Surg.*, vol. 116, page 200.
- GUERNSEY, D. E., WAUGH, J. M. and DOCKERTY, M. B. (1951), *Surg. Gynec. Obstet.*, vol. 92, page 529.
- KING, E. S. J. and MACCALLUM, P. (1940), *Aust. N.Z.J. Surg.*, vol. 10, page 126.
- KIRKLIN, J. W., DOCKERTY, M. B. and WAUGH, J. M. (1949), *Surg. Gynec. Obstet.*, vol. 88, page 326.
- LOCKHART-MUMMERY, J. P. (1926), *Lancet*, vol. 2, page 137.
- MILES, W. E. (1910), *Brit. med. J.*, vol. 2, page 941.
- WAUGH, J. M. and KIRKLIN, J. W. (1949), *Ann. Surg.*, vol. 129, page 22.
- WOOD, W. Q. and WILKIE, D. P. D. (1933), *Edinb. med. J.*, vol. 40, page 321.

ABDOMINAL TOTAL GASTRECTOMY WITH OESOPHAGO-DUODENOSTOMY

By

E. S. R. HUGHES

Royal Melbourne Hospital

AND

P. J. PARSONS

Alfred Hospital, Melbourne

THE treatment of carcinoma of the stomach by partial gastrectomy has proved so disappointing that many surgeons have extended the operation and practise a total excision of the stomach in all cases that are otherwise operable. In most of the recent published series, the operation has been performed through an abdomino-thoracic incision, and the total gastrectomy has been combined with excision of the greater and lesser omenta, the spleen, the body and tail of the pancreas, and portion of the diaphragm and other viscera if they are involved. Continuity is restored by joining the oesophagus to a loop of jejunum brought up either in front of or behind the transverse colon.

The relatively high mortality and morbidity which accompanies this procedure together with the unsatisfactory functional and salvage results have led a number of surgeons to abandon such radical surgery and return once again to the more conservative partial gastrectomy.

In this small series of cases a total gastrectomy was performed through an upper midline abdominal incision and the oesophagus was anastomosed to the duodenum (Fig. 1). In five instances the operation was carried out for carcinoma and in one for a bleeding gastric ulcer situated on the posterior wall of the stomach at the level of the cardia. There were no operative complications. Two died, one five months and the other six months after operation; three were alive and well thirteen months, twelve months and two months after operation respectively. The sixth patient, a man of 80 years with a benign gastric ulcer, was well four and a half months after operation.

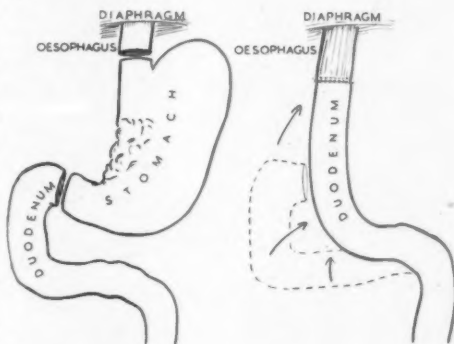


FIG. 1. Total gastrectomy with oesophago-duodenostomy.

CASE REPORTS

These have been condensed to a table form (Table 1). There were four males and two females. The oldest patient was 80 years and the youngest, 47 years. In M.K. (Case 5), a female schizophrenic of 47 years, symptoms had been present for some years; in another, J.J. (Case 4), a male of 75 years, dyspepsia had been troublesome for two years; but in the other three cases, symptoms had only been apparent for some six to eight weeks. In one case, J.P.V. (Case 1), a male of 65 years, the operation was conducted without difficulty under open ether anaesthesia; in the remainder induction with Pentothal was followed by relaxant, nitrous oxide and oxygen, with controlled respiration.

SELECTION OF CASES

Anastomosis of the oesophagus to the duodenum is not likely to be possible when the tumour is situated at either end of the stomach, because of the necessity of excising

portions of the duodenum and oesophagus respectively. Furthermore an abdominal approach is not advocated for a carcinoma in the upper third of the stomach. Cases best suited for the operation are those in which the tumour is situated on the lesser curvature midway between pylorus and cardia (Cases 2, 3 and 4). When the walls of the stomach have been diffusely infiltrated to give a "leather-bottle" stomach, the only chance of palliation may be found in the performance of a total gastrectomy, and there were two such cases in this series (Cases 1 and 5). A benign ulcer rarely calls for such a procedure but when presented with a large eroding ulcer in the neighbourhood of the cardia

the surgeon may find it difficult to conserve any stomach as in Case 6 (Fig. II).

EXTENT OF EXCISION

In the cases of this series the operation was conducted through a midline incision from xiphisternum to umbilicus. A satisfactory exposure has been obtained without need of extension, an experience similar to others (Longmuire, 1947).

In the resections for malignant disease the greater and lesser omenta were removed with the stomach. The left gastric vessels were ligated at their origin as were the right gastric

TABLE 1

Case No.	Initials	Sex	Age	Duration of Symptoms	Chief Symptoms	Date of Operation	Incision	Findings	Procedure	Convalescence	Follow-up
1	J.P.V.	M	65	2 months	Epigastric pain aggravated by food. 7 lbs. weight loss	24 Aug., 1953	Upper midline abdominal incision	"Leather-bottle" stomach	Total gastrectomy, splenectomy, oesophago-duodenostomy	Uneventful	13 months, well
2	J.B.	M	52	2 months	Epigastric pain	18 Sept., 1953	Upper midline abdominal incision	Carcinoma involving the middle third of lesser curvature of stomach	Total gastrectomy, splenectomy and partial pancreatectomy, oesophago-duodenostomy	Uneventful	12 months, well
3	F.W.	F	72	6 weeks	Epigastric pain and vomiting	18 July, 1953	Upper midline abdominal incision	Carcinoma involving the middle third of lesser curvature of stomach	Total gastrectomy, oesophago-duodenostomy	Uneventful	Developed secondaries in liver and peritoneum. Died 3 Dec. 53
4	J.J.	M	75	2 years	Epigastric pain and loss of weight	20 Jan., 1953	Upper midline abdominal incision	Carcinoma involving the middle and upper thirds of lesser curvature of stomach	Total gastrectomy, oesophago-duodenostomy	Uneventful	Readmitted 2 June, 53. Persistent burning epigastric pain aggravated by food. No vomiting or regurgitation. Nothing abnormal found on endoscopic exam. Died 4 July, 53
5	M.K.	F	47	5 years	Epigastric pain been worse over past 7 weeks	29 July, 1954	Upper midline abdominal incision	Early "leather-bottle" stomach	Total gastrectomy, splenectomy and partial pancreatectomy, oesophago-duodenostomy	Uneventful	2 months, well
6	C.N.	M	80	2 years	"Indigestion" haematemesis and melaena	26 May, 1954	Upper midline abdominal incision	Posterior wall gastric ulcer, adjacent to oesophago-gastric junction	Total gastrectomy, oesophago-duodenostomy	Uneventful	4½ months, well

and gastro-epiploic vessels. The spleen was removed if the gastro-splenic ligament was short (Cases 1, 2 and 5). The pancreatic body and tail was removed in Cases 2 and 5 (Fig. III), but this extension was not considered necessary in the remaining cases. The excision can be as radical as that obtained with the abdomino-thoracic approach (Evans, 1954).



FIG. II. Case 6. C.N., male, 80 years. Total gastrectomy for benign gastric ulcer situated on the posterior wall of the stomach in close relation to the cardia. There were other smaller ulcers above and below the main ulcer.

As with colonic surgery the amount of bowel removed is governed largely by the extent of lymphatic resection. To remove the glands around the pylorus, the cardia and along the gastric and gastro-epiploic vessels nothing short of total gastrectomy can suffice.

ANASTOMOSIS OF OESOPHAGUS TO DUODENUM

In this series continuity was restored by anastomosing the oesophagus to the duodenum. The duodenum was mobilized by dividing peritoneal bands on its outer side

and by incising the peritoneum along the second part. In some resections it was hoped to carry out an oesophago-duodenostomy but it was obvious when the time came to do the anastomosis that excessive tension on the suture line would render such a union unsafe and the plan was abandoned in favour of a jejunal "replacement" or a jejunal loop. Doubilet (1954) reports that he occasionally divides the cystic artery and duct to allow the duodenum to move upwards, but this has not been done in this series.



FIG. III. Case 5. M.K., female, 47 years. Total gastrectomy, splenectomy, partial pancreatectomy and excision of greater and lesser omenta for carcinoma of the stomach. There is a diffuse infiltration along the lesser curvature aspect of the stomach and into the posterior wall.

The anastomosis was composed of two layers—an outer layer of interrupted fine silk and an inner layer of continuous fine chromic catgut. The posterior portion of the anastomosis was completed before the stomach was fully severed from the oesophagus.

POST-OPERATIVE COURSE

A tube was placed down the oesophagus and into the duodenum before the anastomosis was completed and it was kept in place for

eight days. This precaution may be unnecessary (Re Mine and Priestly, 1952) but its use was retained in this series because it did not upset the patient and it helped to remove the possibility of distension of the duodenum endangering the suture line.

POST-OPERATIVE RADIOLOGICAL INVESTIGATION

In five of the six cases forming the series a radiological examination was performed two to six weeks after operation. An emulsion of barium was swallowed and the patient was



(a)



(b)

FIG. IV. Case 1, J.P.V., male, 65 years. Post-operative barium meal examinations, (a) two months after operation, (b) nine months after operation.

Nothing was permitted orally until the seventh day, and then for the first forty-eight hours only an ounce each hour. This amount was gradually increased over the next week so that on discharge from hospital the patient was taking six small feeds daily. Intravenous therapy was maintained until sufficient fluids were taken orally to allow its withdrawal.

Routine post-operative chemotherapy was not considered necessary. The site of the anastomosis was not drained. The patient was allowed out of bed on the eighth post-operative day and to the bath on the tenth post-operative day.

screened and films were taken. In each case the anastomosis was widely patent and the barium flowed freely through the duodenum into the small intestine. In two cases (Cases 1 and 2) the radiological examination was repeated about eight months after operation and little change was noted. There was no appreciable dilation of the oesophagus or of the duodenum; the anastomotic site was difficult to locate (Figs. IV, V, VI, VII, VIII).

POST-OPERATIVE FUNCTIONAL RESULT

The functional results have been most encouraging, although all cases showed the usual lack of food capacity which follows total gastrectomy. Attempts to partake of

large meals resulted in epigastric discomfort, sometimes amounting to pain, but small nutritious meals taken at 2 hourly intervals or less caused no distress at all.

(J.P.V., male, aged 65 years) it was nine pounds under the usual 11 stone, and in Case 2 (J.B., male, 52 years) it was also nine pounds under the usual 9 stone. Both these

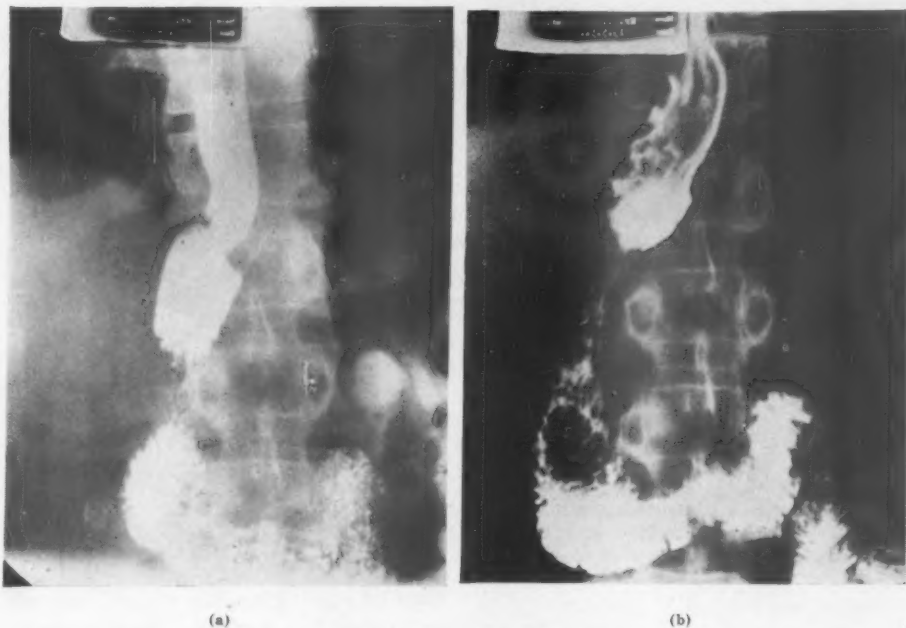


FIG. V. Case 2, J.B., male, 52 years. Post-operative barium meal examinations, (a) three weeks after operation, (b) eight months after operation.

Two patients subsequently developed dysphagic symptoms. The first, F.W. (Case 3, female, aged 72 years), five weeks after operation complained that swallowing caused discomfort. It was thought at first that this was caused by narrowing of the anastomosis, or was the sequel of anastomosing the oesophagus to the duodenum under some tension. However the barium meal revealed no abnormality; palpable liver and peritoneal metastases shortly after suggested that they were responsible for her symptoms. A similar fate befell J.J. (Case 4, male, aged 75 years), when abdominal carcinomatosis was heralded by the appearance of dysphagia five months after operation. The dumping syndrome did not occur in this small series.

Failure to regain the usual pre-operative weight was seen in each case, but the weight deficiency was small; for example, in Case 1

patients were farmers and had sufficient energy and strength to do their normal farm work without distress.

So far anaemia has not been a problem. J.P.V. (Case 1, male, 65 years) has survived thirteen months and has a haemoglobin of 12.8G; J.B. (Case 2, male, 52 years) has a haemoglobin of 14.0G after twelve months.

DISCUSSION

Total gastrectomy followed by oesophago-duodenostomy is not commonly done although several surgeons have commended the procedure recently (Palumbo, 1950; Sweet, 1953; Desmond, 1954; Doubilet, 1954; Schmitz, Harkins, Moore and Olson, 1954, and Smith, 1954). Pack and McNeer (1943) in their comprehensive review of the literature found that 54 cases had been then recorded. Re 'Mine and Priestly (1952)

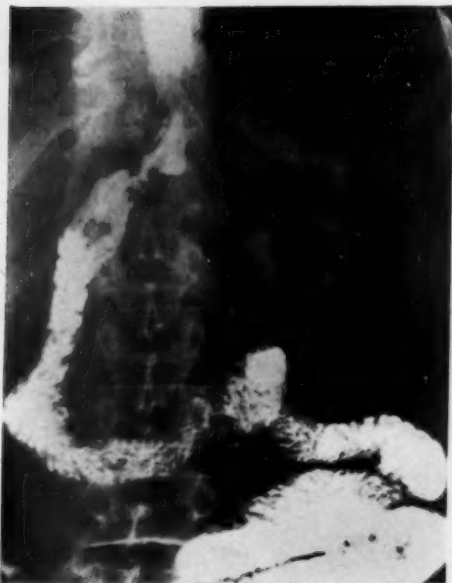


FIG. VI. Case 3, F.W., female, 72 years. Post-operative barium meal examination. Six weeks after operation.



FIG. VII. Case 4, J.J., male, 75 years. Post-operative barium meal examination. Five months after operation.

reported that only 15 such operations were done at the Mayo Clinic from 1917 to 1948 and most of these only in recent years. In many communications concerning total gastrectomy little or no mention is made of oesophago-duodenostomy.

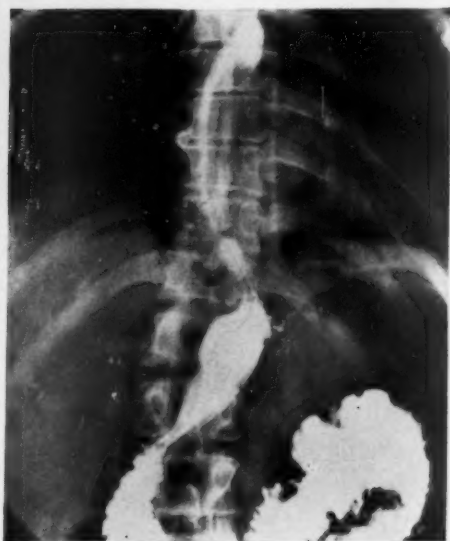


FIG. VIII. Case 5, M.K., female, 47 years. Post-operative barium meal examination. Six weeks after operation.

It is appreciated that the operation has disadvantages and is applicable to a limited number of cases. If the oesophagus is to be anastomosed to the duodenum without tension the surgeon cannot afford to be liberal with his excision of duodenum and oesophagus. Lahey and Marshall (1950) believe that the duodenum should be excised almost to the point at which the common bile duct enters the second part because of the possible intramural spread of the tumour; furthermore the nodes around the pylorus may be so intimately related to the first part of the duodenum that only by its excision can such nodes be satisfactorily removed. The operation is not advocated for tumours situated at either end of the stomach, but is best used in cases in which there is a carcinoma within the body of the stomach with no evidence of spread, and in which there is a relatively mobile duodenum. Desmond (1954) recorded

eight cases, and expressed the view that the operation was indicated in patients of advanced years with growths not involving oesophagus or within one inch of it; he favours the procedure in any patient with a small carcinoma of the media of the stomach. A decision as to whether the operation will be possible cannot be made until the abdomen has been explored (Priestly and Kumpuris, 1948).

The major advantage of the operation is its simplicity. The whole procedure can be completed in one to two hours. The extent of the excision can be as radical as that obtained through an abdomino-thoracic approach, and it is accomplished with little disturbance to the patient; in none of the patients of this series were there immediate post-operative complications. One of the patients was 80 years of age and was subjected to laparotomy as an emergency procedure because of haemorrhage; the ulcer was situated high up on the posterior wall of the stomach. One of Desmond's cases was over 80 years and three were operated on because of haemorrhage (Desmond, 1954).

Two patients subsequently developed discomfort on swallowing; both died soon after the symptoms appeared with recurrence of carcinoma in the abdomen. There has been no dysphagic symptoms in the other four patients. Evans (1954) describes a case which developed dysphagia and which he believed was due to an oesophagitis caused by regurgitation of alkaline intestinal juices with ulceration, haemorrhages, and pain. His case was kept under control with a special citric acid and sodium citrate mixture. Desmond (1954) stated that he had not observed any such cases in his series of eight. Both the patients developing dysphagia in our series were X-rayed and no abnormality was found; in Case 4 (J.J., male, aged 75 years) a gastroscope was passed into the duodenum and nothing abnormal was seen. It is of interest that Paulson (1953) examined two patients endoscopically three and a half months and three years after oesophago-duodenostomy and was unable to find any alteration in the appearance of the mucosa.

Weight loss, or at least failure to regain pre-operative weight, and loss of strength and energy are common complaints after

total gastrectomy (Kelly, Maclean, Perry and Wangenstein, 1954). These symptoms appear to be due mainly to reduced food intake, but faulty food assimilation may also be a factor. In this respect Everson (1952) found that there is less loss of faecal nitrogen after oesophago-duodenostomy than after oesophago-jejunostomy. Anaemia has not proved a problem in this series, but it is well recognized; it is usually microcytic due to iron deficiency, but a macrocytic anaemia may occur after a longer interval (Anglem, 1954).

In the great majority of cases (5 out of 6 cases in our series) total gastrectomy has been performed for malignant disease in the older age groups. Even with the most radical resection life expectancy is poor; 42 per cent. survive one year, 24 per cent. two years, and 16 per cent. four years (Sweet, 1953). It is therefore unjustifiable to perform a procedure which leaves the patient miserable and makes life a burden. Total abdominal gastrectomy with oesophago-duodenostomy has been accompanied by a low mortality and morbidity rate and is compatible with a return to a normal life, with pleasurable sensation of appetite and hunger, except in so far as the patient needs frequent small meals of high calorific value, and rich in protein and fat.

SUMMARY

1. Six cases are reported in which a total gastrectomy was performed through a midline incision in the upper abdomen, and in whom continuity was restored by anastomosing the oesophagus to the duodenum.
2. Five of the cases were suffering from carcinoma and one from a benign ulcer in immediate relation to the cardia.
3. The operation is suitable to those cases in which there is a tumour in the middle third of the stomach (3 cases of this series) and those with "leather-bottle" stomachs (2 cases). Rarely a benign gastric ulcer can only be treated by total gastrectomy (Case 1).
4. The extent of the excision in malignant cases is as radical as that obtained by abdomino-thoracic approaches.

5. The decision to anastomose the oesophagus to the duodenum is one that can only be made at operation.
6. The post-operative course in these six patients has been smooth.
7. A post-operative barium meal revealed that there was no tendency towards stricture formation, that the meal passed freely into the small intestine.
8. The functional result has proved satisfactory. The patients have been little inconvenienced by the loss of their stomach, provided they realize the importance of frequent small meals of selected food-stuffs.
9. No claim is made that total abdominal gastrectomy will materially influence the long-term results in carcinoma of the stomach, but it is a procedure which in our hands has proved satisfactory and when combined with anastomosis of the oesophagus to the duodenum has resulted in a return to a practically normal life.

ACKNOWLEDGEMENT

We would like to express our thanks to Mr. Roy Inglis for his photographs which illustrate this article.

REFERENCES

- ANGLEM, T. J. (1954), *Ann. Surg.*, vol. 139, page 368.
- DESMOND, A. M. (1954), *Proc. R. Soc. Med.*, vol. 47, page 264.
- DOUBILET, H. (1954), *Surg. Clin. Nth. Amer.*, vol. 34, page 441.
- EVANS, D. (1954), *Proc. R. Soc. Med.*, vol. 47, page 263.
- EVERSON, T. C. (1952), *Internat. Abst. Surg.*, vol. 95, page 209.
- KELLY, W. D., MACLEAN, L. D., PERRY, J. F. and WANGENSTEEN, O. H. (1954), *Surgery*, vol. 35, page 964.
- LAHEY, F. H. and MARSHALL, S. F. (1950), *Ann. Surg.*, vol. 132, page 540.
- LONGMUIRE, W. P. (1947), *Surg. Gynec. Obstet.*, vol. 84, page 21.
- PACK, G. T. and McNEER, G. (1943), *Internat. Abst. Surg.*, vol. 77, page 265.
- PALUMBO, L. T. (1950), *J. Internat. Coll. Surg.*, vol. 14, page 267.
- PAULSON, M. (1953), *Gastroenterology*, vol. 23, page 593.
- PRIESTLY, J. T. and KUMPURIS, F. (1948), *Arch. Surg.*, vol. 56, page 145.
- RE MINE, W. H. and PRIESTLY, J. T. (1952), *Surg. Gynec. Obstet.*, vol. 94, page 518.
- SCHMITZ, E. F., HARKINS, H. N., MOORE, H. G., OLSON, H. H. (1954), *Lancet*, vol. ii, page 4.
- SMITH, C. A. (1954), *Surg. Clin. Nth. Amer.*, vol. 34, page 457.
- SWEET, R. H. (1953), *Ann. Surg.*, vol. 138, page 297.

THE BLOOD SUPPLY OF THE THYROID GLAND

III.—THE HISTOLOGY OF THE THYROID VESSELS

By NEIL JOHNSON

Department of Pathology, University of Melbourne

IN two previous communications (Johnson, 1953, 1954) the results of experiments dealing with the anatomy of the smaller vessels of the thyroid gland have been presented. In these papers it has been shown that the thyroid gland is an organ composed of well-defined lobules which may be regarded as the unit of structure—a matter of considerable importance when considering the various morphological changes to be found in a gland functioning abnormally. Each thyroid lobule consists of 20-40 vesicles bound together by a fine connective tissue sheath and receiving their blood supply by way of the lobular artery—a terminal branch of the ramifications of the major thyroid vessels.

It has been demonstrated further that the anatomical lobes of the thyroid gland, as generally recognized, are in fact aggregates of many discs of tissue which have been termed the structural lobes of the gland. Each structural lobe may be further subdivided into many lobules as defined above.

Thus three orders of structure may be recognized within the adult thyroid gland:

- (a) the lobule—comprising 20-40 vesicles bound together in loose connective tissue;
- (b) the structural lobe—consisting of a group of lobules bound together in a common connective tissue sheath;
- (c) the anatomical lobe—consisting of many structural lobes surrounded by a condensation of connective tissue, this layer of tissue being the capsule of the gland.

The thyroid vessels ramify amongst these various structural elements in a well-defined fashion. The gland receives its arterial inflow via the superior and inferior thyroid arteries (with the occasional addition of a third vessel—the thyroidea ima). These vessels branch and ramify extensively on the surface of the gland where they form frequent anastomoses. While coursing over the surface

of the thyroid tissue, its major arteries send off numerous branches, which, plunging through the capsule, run in the fibrous septa between structural lobes. Here further subdivision takes place and vessels leave the fibrous septa between structural lobes to enter their substance. Once within the structural lobe the arteries divide into a number of branches—the lobular arteries—supplying the thyroid lobules.

Within the lobule the lobular artery divides into a series of twigs supplying the vesicles, each individual vesicle being supplied by a capillary plexus. The venous system of the organ begins with the confluence of venules draining blood from the vesicular capillaries to form a lobular vein. Lobular veins run together to form larger vessels within the structural lobes and these vessels in turn drain into large veins accompanying the principal arteries in their course, as has been described above. Further details of this vascular anatomy have been given previously (Johnson, 1953).

Present investigation

Having established definite and clear concepts of normal thyroid structure, attention was directed towards the changes to be observed in that pattern when the gland became the seat of pathological processes. It was demonstrated that the common nodule seen in the thyroid gland was merely an hypertrophied thyroid lobule (Johnson, 1954).

Evidence in support of this concept of the nature of the thyroid nodule is briefly as follows:

- (1) On examining the nodular goitres containing nodules of all sizes, it becomes clear that, if one observes a series of nodules of progressively diminishing size, the smallest of the nodules are indistinguishable from the larger normal lobules of the gland.
- (2) Small nodules (like the normal lobule from which they are derived) possess

a well-defined arterial supply and well-defined capsule. In point of fact their artery of supply is merely the hypertrophied lobular artery.

Now it is known that changes in activity of thyroid epithelium can be produced by a variety of stimuli. One result of these changes may be that the thyroid lobule increases in size; the increase in size may be associated with the histological picture of either hyperplasia or involution in the component vesicles but this, for the moment, may be ignored—the size change being the important point.

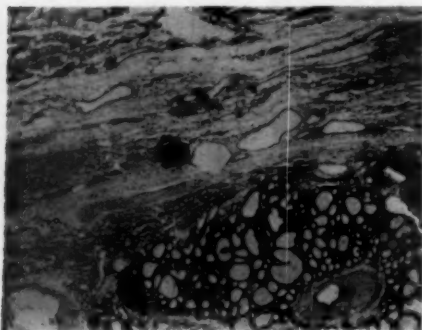


FIG. I. Photomicrograph of a routine histological section of a nodular goitre. The junction between a nodule (in the lower half of the photograph) and the surrounding gland is shown. Note the group of relatively large vessels in the capsule of the nodule. These vessels are lobular vessels persisting after atrophy of the perinodular thyroid tissue. (x 30)

Should this change affect the lobules of the gland diffusely the macroscopic morphology of that gland will be either that of a colloid goitre or of a diffusely hyperplastic goitre—depending on the nature of the stimulating agent. Should, however, the process affect some lobules more grossly than their neighbours, then a nodular goitre will develop. Now the factors determining the concentration of a stimulating agent in a given lobule are clearly related intimately to the blood supply of that lobule and it is possible that two factors may influence the quantity of blood flowing into a thyroid lobule in a given period of time. These are:

- (a) changes in blood flow may be brought about by alterations in calibre of the vessels of supply, that is, essentially

an aberration of a physiological mechanism;

- (b) changes in blood flow may be precipitated by the presence of disease processes within the walls of the lobular arteries, or indeed in vessels of greater size. These processes—by varying vessel calibre, could presumably alter the rate of flow through these vessels.

In an attempt to determine the relative importance of these two factors, sections taken from a group of 200 goitres have

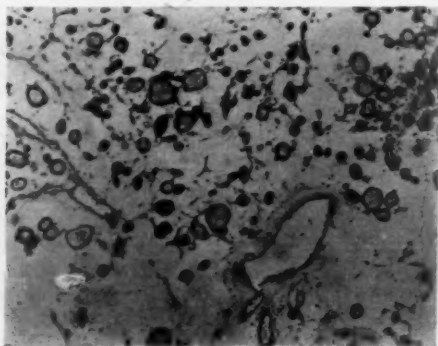


FIG. II. Photomicrograph of a routine section of a portion of a nodule (of "foetal" type) in a nodular goitre. A thin-walled "giant" vessel is to be seen surrounded by pale acidophil material and many small vesicles (compare Fig. V). (x 60)

been examined. In this collection of thyroid glands there have been 102 examples of nodular thyroid, 56 examples of diffusely hyperplastic goitres and 42 examples of colloid goitre. The method of investigation used has been of simple microscopic inspection of one or more sections taken from each case of thyroid dysfunction. Each section or group of sections was inspected with two objects in view:

- (a) to determine the general nature of the epithelial changes within the thyroid;
- (b) to examine the vessels present in the section, an attempt being made to assess the state of the major intraglandular vessels, the lobular arteries and the capillaries.

The results of this investigation are discussed below.

RESULTS

Attention was directed in each group of slides to vessels of various orders. The observed results may be dealt with as follows:

(a) Major arteries

Often the surface vessels of the thyroid were not present in any of the sections taken from a given gland. When present however, it was observed that the majority was of normal structure. Occasional examples of medial hypertrophy were observed in both diffusely enlarged and nodular glands, the distribution of these changes being quite random in its incidence. It may be inferred from these observations that structural changes in major vessels play no part in the determining of nodular changes within the thyroid.

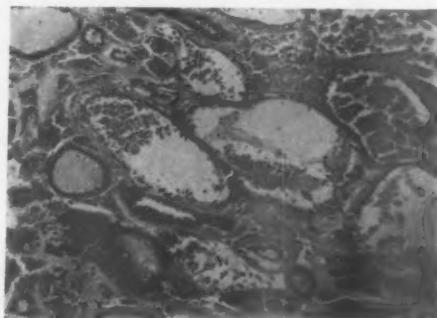


FIG. III. Photomicrograph of a routine section of a nodular goitre. The photograph shows a group of dilated thin-walled vessels. The walls of these vessels consist of a layer of endothelium surrounded by a condensation of connective tissue. (x 130)

(b) Intra-glandular arteries

In routine histological sections, arteries of various sizes occur at different sites within the thyroid tissue. It was found to be quite impossible to determine with accuracy the exact anatomical type of these vessels. The larger of these arteries, running in well-defined septa, are clearly those vessels running between structural lobes; smaller vessels, however, cannot be accurately classified and so are dealt with as a group.

Again, close inspection of these vessels showed that the majority was of normal

histological structure irrespective of whether they occurred in a gland which was the seat of nodular changes or in a diffusely enlarged gland. Occasional examples of medial hypertrophy of these vessels were observed but again they appeared to have no relation to the type of process which was occurring within the gland. The difficulties in assigning any definite name to these vessels, as they appear in routine histological methods of investigation, is obvious to any who have inspected histological sections of thyroid tissue. The methods of perfusion and thick frozen section described previously (Johnson, 1953) are necessary to elucidate the precise nature of these vessels.

The value of perfusion experiments as methods of investigation is well emphasized when one seeks information on the capillaries of the thyroid. In histological sections, capillaries are not obvious and no accurate

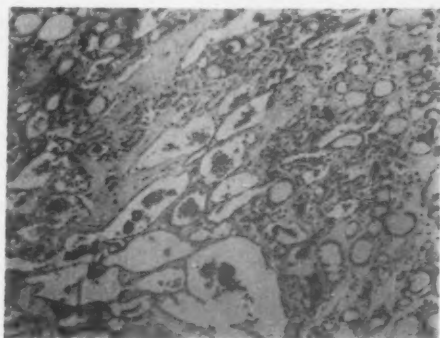


FIG. IV. Photomicrograph of a routine section of a nodular goitre showing a group of thin-walled "giant" vessels of various sizes (compare Fig. VI). (x 75)

ideas can be formed as to their arrangement in relation to the vesicles. Perfusion technique indicates that each vesicle is supplied by a capillary plexus, whose density varies with the activity of the epithelium in that vesicle.

Changes observed in nodular glands

(a) Changes in vessels around a developing nodule

As is well recognized the enlarging thyroid nodule develops a layer of fibrous tissue surrounding it, forming a capsule. Frequently, in this capsule, one observes numerous vessels

of moderately large size (Fig. I). Terry (1922) observed these vessels and assumed erroneously that they formed the source of supply to the enclosed thyroid nodule. Injection experiments (Johnson, 1954) have resolved this point and have shown that these larger vessels are in fact lobular arteries and veins which persist for some time after the disappearance of the lobules which they supplied during the process of enlargement of the thyroid nodule. By following the vascular pattern as demonstrated by injection methods in a series of nodules of increasing size, it becomes obvious that, parallel with the disappearance of vesicles and lobules in the tissue surrounding the enlarging nodule, there is a modification of capillary bed so that the complex vesicular pattern is lost and is replaced by a simple pattern characteristic of connective tissue. The lobular arteries and veins do not disappear at such a rapid rate (presumably because they supply more than vesicles and are therefore amongst the last structures to atrophy) and so persist as the vessels described above.

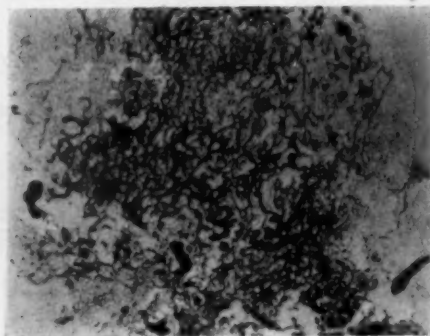


FIG. V. Photomicrograph of a thick section (150 μ) of an injected nodular goitre. Portion of the injected capillary bed is shown and there are a few, though relatively small, dilated vessels present in the section. (x 15)

(b) Changes observed in vessels within the nodule

While most of the vessels observed by histological study in the interior of thyroid nodules have normal morphology, one occasionally detects abnormal vessels within the nodule. The most striking of these abnormal vessels is the large, thin-walled, dilated vessel occasionally found within a thyroid nodule.

These vessels may occur singly (Fig. II) or in groups of several vessels closely aggregated (Figs. III and IV). They have been recorded previously on both histological examination (Boyd, 1947) and on perfusion of the gland (Wangenstein, 1929). Once again histological measures give little evidence of either the extent or function of these vessels. Perfusion experiments on the other hand, demonstrate them much more adequately (Figs. V and VI). The sinusoidal vessels are thin walled, being lined by a layer of endothelium surrounded merely by a thin layer of condensed connective tissue. Often vessels of capillary size may be observed opening directly into these vessels (Fig. VII). Occasionally, in some of the larger vessels, a layer of smooth muscle develops in their wall (Fig. VIII). As might be expected they are possessed of little mechanical strength, evidence of this being seen both in histological sections, where extensive haemorrhage is common and in perfusion experiments

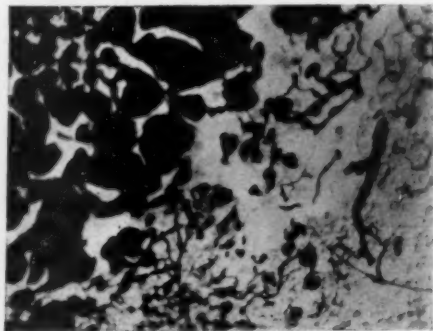


FIG. VI. Photomicrograph of a thick section (150 μ) of an injected nodular goitre. A group of grossly dilated "giant" vessels filled with perfusion medium is clearly seen (compare Fig. IV). (x 60)

when rupture of these vessels and escape of medium is commonly seen.

One further point deserves mention. It is common to see these giant vessels in nodules showing the histological picture of many small vesicles associated with an extensive amount of loose acidophil pale-staining material usually referred to as extra-vesicular

colloid; indeed, such association is so common as to be almost the rule. Occasionally giant vessels may be observed in nodules composed of collections of small alveoli, without any obvious alteration in the connective tissue. Whilst it is tempting to infer that the giant vessels and the condition of the

that occasionally areas of hyperplastic thyroid epithelium occur within a nodule. Examination of these areas in histological preparations gives little indication of their vascularity (Fig. IX). Perfusion experiments show areas of dense tortuous sinusoidal vessels within thyroid nodules, and in these preparations the

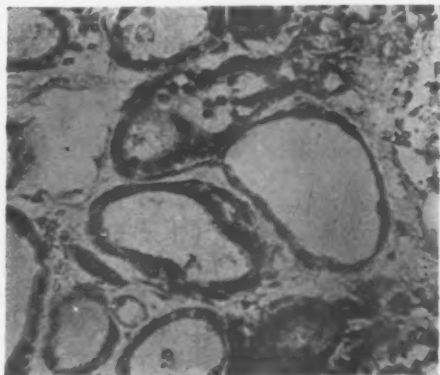


FIG. VII. Photomicrograph of a routine section of a nodular goitre. In the middle of the photograph there is a thin-walled "giant" vessel and a capillary running between two vesicles may be seen to open directly into the giant vessel. (x 200)

connective tissue are related (the appearance of the vessels perhaps determining the connective tissue change) there is insufficient evidence as yet to support this hypothesis.

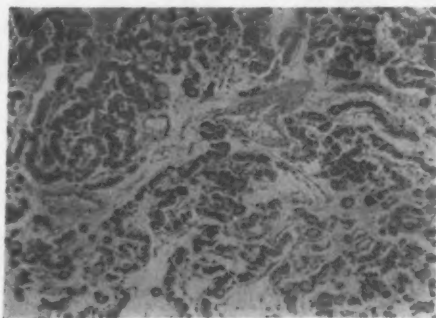


FIG. IX. Photomicrograph of a routine section of a cellular area in a nodular goitre. Cells are arranged in irregular columns and careful inspection shows many blood vessels between these columns of cells (compare Fig. X). (x 100)

The second change observed in intra-nodular vessels demonstrates once again the value of perfusion as a method of investigation. It is common histological knowledge

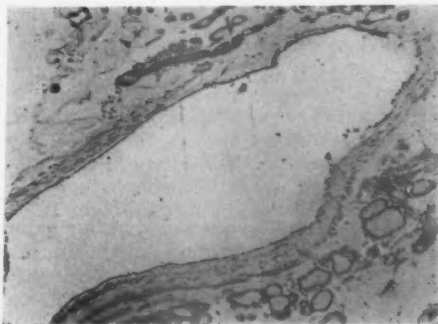


FIG. VIII. Photomicrograph of a routine section of a nodular goitre showing an extremely large thin-walled vessel which has developed a thin layer of smooth muscle in its wall. (x 60)

significance of these areas is not quite clear. However, by combining both methods and perfusing a gland before cutting routine histological section from an area known to have these tortuous vessels, it becomes obvious that these vessels occur in the hyperplastic areas referred to above (Fig. X).

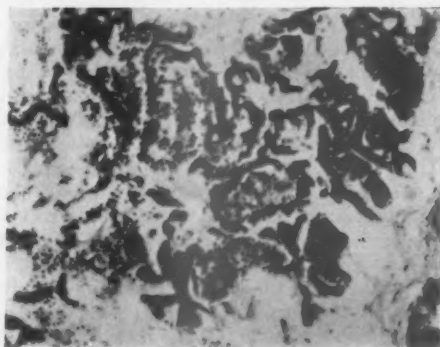


FIG. X. Photomicrograph of a section of an active area from an injected nodular goitre. This area is comparable to that shown in Fig. IX. While the cytological detail is poor (due to the tissue autolysis) the relation of the columns of cells to the dilated capillaries (densely black) can be readily observed. The injection naturally renders the capillary bed much more obvious than in an uninjected section (compare Fig. IX). (x 80)

DISCUSSION

It would appear, from the observations described above, that morphological changes in the thyroid vessels are uncommon, that they may occur in both diffusely and locally hyperplastic glands, and that, when occurring in the nodular thyroid, because they are variable and irregular in incidence they cannot be regarded as being important in the development of nodularity within the gland.

Turning now to alternative hypotheses which may be developed to explain the localization of alterations in thyroid tissue, there are clearly two possibilities:

- (a) that the vascular pattern is altered by evanescent changes in function rather than by permanent or semi-permanent structural changes within the vessels;
- (b) that the evolution of nodular changes is independent of vascular pattern, being determined rather by variation in the ability of the target cells to react under a given applied stimulus.

It is known that the thyroid epithelium does vary in certain respects in its ability to respond to a given stimulus. Should that stimulus be the administration of a quantity of iodine, the uptake of that iodine within the gland may not be uniform, but may occur in a patchy fashion. These facts have been well demonstrated by radio-active techniques employing the isotope I^{131} . However, examination of results of this type of experiment shows that the iodine uptake occurs in an irregular fashion in both pathological and histologically normal glands and it is difficult to correlate this finding with the notion that these variations in activity determine the occurrence of nodularity in a gland. Were it possible to show that a single lobule had a greater uptake than its neighbours, then it would be reasonable to assume that, over a period of time, that lobule may enlarge and ultimately become a nodule. Findings of this type have yet to be demonstrated and at this stage it would be premature to assume that, in the thyroid gland, the final morphological changes with which we are familiar are the result of this type of change.

On examining the first possibility described above, that is to say, that nodularity is a result of physiological variations in blood

flow to different areas of the gland, it is obvious that, as yet, there is insufficient evidence available to arrive at a final conclusion. It has been shown that thyroid tissue is supplied by a progressively dividing vascular system until ultimately each lobule receives a lobular artery. It is also known that inter-arterial and arterio-venous anastomoses occur between the vessels of various orders within the gland itself. Thus in this arrangement of vessels there is the possibility of physiological variations whereby:

- (a) alterations in calibre of the lobular artery,
- (b) the opening or closing of arterio-venous shunts situated in relation to one or more lobular arteries, and
- (c) the opening or closing of inter-arterial communications, could lead to the decrease or increase in blood flow in a given thyroid lobule for a variable period of time.

Further, it is now well recognized that arterioles, arterio-venous and intra-arterial communications are under control of both circulating hormones and the autonomic nervous system and thus there exists, in the thyroid gland, not only a vessel pattern but also the means of control of that vascular system whereby variations in blood-flow to the thyroid lobule could be produced. Clearly these propositions require further demonstration but the point to realize is that the anatomical pattern has been demonstrated to be of sufficient complexity for these changes to occur.

Turning now to the changes seen in the nodular gland, the giant vessels and areas of sinusoidal vessels in association with hyperactive epithelium have been noted and their histological structure briefly described. A further point deserves mention. By the perfusion technique it has been shown that these vessels act as intra-nodular arterio-venous shunts under the conditions of perfusion. It is pertinent here to discuss further the conditions under which perfusion is conducted. Glands are allowed to stand for at least eighteen hours after death before perfusion is attempted. The reason for this is that, during this period of time any post-mortem spasm of smooth muscle (rigor mortis) in the vessel wall disappears and the medium is allowed to

flow freely through the vascular tree. Now, when this is done the path taken by medium flowing through the vessels of the nodule will be determined by relatively straightforward hydrodynamic factors (that is, without the intervention of the complicating influence of vasomotor control), and in such circumstances the medium flows through the nodules or part of them via the vessels described above and fills the veins. It fails to fill the surrounding capillary bed.

During life all areas of the nodule clearly possess a blood supply and it may be deduced from observations on the tissues that vasomotor control must play some part in the distribution of blood to these intra-nodular areas and the prevention of giant vessels or sinusoidal areas from acting as intra-nodular arterio-venous shunts. Thus in the thyroid gland, vasomotor control of the vessels which is operative in all tissues, is of particular importance in the maintenance of tissue nutrition within the thyroid nodule. These factors are of some importance in the development of haemorrhage and necrosis within thyroid nodules. Presumably, if the intra-nodular arterio-venous shunts become active for any period of time during life then the tissue in other areas of the nodule would undergo degenerative changes which may be so gross as to amount to frank necrosis.

The small mechanical strength of the giant vessels has already been discussed. In haemorrhagic thyroid nodules one can frequently observe many of these giant vessels and the frequent association of these vessels with haemorrhage would appear to be a significant one. It has been demonstrated (Johnson, 1954) that these sinusoidal vessels will rupture if subjected to pressures of 80-100 mm. of mercury, that is to say, pressures well below arterial pressures. Disturbances in vasomotor control of intra-nodular vessels could raise the pressure in

these sinusoidal vessels to these limits by the opening of arterio-venous shunts thereby causing haemorrhage into the thyroid nodules. The changes found in these necrotic and haemorrhagic thyroid nodules will be the subject of a further communication.

SUMMARY

1. An investigation into the histological features of the vessels seen in 200 cases of thyroid enlargement has been presented.
2. Whilst morphological changes can be demonstrated occasionally in the vessels of both diffusely enlarged and nodular goitres, there is no evidence to suggest that the presence of these changes in the thyroid vessels determines the development of the nodular goitre.
3. The presence of giant thin-walled vessels in some thyroid nodules is described and their function and structure has been determined by means of perfusion experiments.
4. The vessels to be seen in association with areas of active epithelium within the thyroid nodule have been demonstrated by means of injection techniques.
5. The significance of these changes in the development of haemorrhage and necrosis in thyroid nodules has been discussed briefly.

REFERENCES

- BOYD, W. (1947), "Surgical Pathology." Philadelphia, W. B. Saunders Company, Sixth Edition, page 188.
- JOHNSON, N. (1953), *Aust. N.Z.J. Surg.*, vol. 23, page 95.
- (1954), *Aust. N.Z.J. Surg.*, vol. 23, page 241.
- TERRY, W. I. (1922), *J. Amer. med. Ass.*, vol. 79, page 1.
- WANCENSTEEN, O. H. (1929), *Surg. Gynec. Obstet.*, vol. 48, page 613.

DENERVATION OF THE KNEE JOINT

By O. W. LEITCH

Adelaide

THE relief of painful joint conditions, particularly those of advancing age, presents an ever-increasing problem as medical science is advancing the life span of the population as a whole.

As these changes, particularly the osteoarthritic, have developed with time and are in themselves irreversible, unless preventive medicine can forestall their development, those of us who are destined to reach middle age and over are potential sufferers.

Add to this group the traumatic arthritis consequent on increased industrialization and and vehicle accidents the problem in the treatment of this disease amounts still more. Conservative physiotherapeutic measures, particularly heat in various forms, have for many years been the surgeons stand-by, and like all somatic pains, the salicylate group have long had a well-deserved reputation for providing, at least, some temporary relief, well exploited by the makers of these drugs both in writing and picture. Recently, more powerful drugs such as the cortisone group and butazolidine have had varied success, particularly the latter, but the dangers attendant on their use have made general application difficult.

Such procedures as the intra-articular injection of procaine in various forms or procaine nerve block of the relevant joint supply have, in many cases, produced relief for the varying periods. In view of this success and the alternative major surgical procedures required to produce a painless joint, a logical approach to the problem should be to remove the nerve supply permanently. Arthrodesis in an elderly person, while producing a painless joint, is generally a major performance, a prolonged convalescence, often in plaster, or other immobilization and leaves the disability of a fixed joint which, however, is often gladly accepted by the patient for the relief it affords, in some circumstances this is the best that may be available.

Reconstruction operations have been tried for many years, improvement in surgical technique paving the way for more ambitious procedures. The aim being a painless, but movable joint. The ideal is there but when one considers that the pathology existing in the tissue is not confined to the radiological changes exhibited, it is not surprising that the post-operative phase is not always what one would wish.

If an inflammatory condition has existed in a joint, which means bone articular cartilage, synovia capsule and surrounding muscles over a long period, further trauma in the form of operative interference must further involve a traumatic inflammation particularly where this operation is extensive. Many successful arthroplasties and replacement arthroplasties have been done but these are practical in the main in only certain of the joints and the results are far from perfect.

The general temporary success with procaine injection has led to the development of a permanent pain relief by severance of these nerves to replace the unsatisfactory semi-permanent alcohol injection.

To the student, the nerve supply to a joint does not go much beyond Hilton's law that a joint receives its supply to correspond to the muscles that move the joint. This may be correct enough in the circumstances but it may be more accurate to refer to segmental origin rather than individual nerves. Gardner (1948) has done an enormous amount of painstaking research on the supply to joints clearing up many of the existing irregularities and omissions current in the standard anatomical text-books.

Others have attacked the problem of denervation surgically and now large series have been produced particularly in relation to the hip and the success or failure appears to depend on the variation of the supply which the surgeon must constantly bear in front of his mind.

Nerves anywhere in the body have a habit of varying the route by which they reach their destination and the development of the great plexuses, the more distal communications and branches bear witness to this. Embryological factors to take a hand which is well seen in the obturator supply to the hip which may come as a whole or in any combination from the obturator trunk, posterior branch, anterior branch, accessory obturator or nerve to the pectineus, all of which are parts of this nerve. Whether the joint supply is carried in the pectineal branch or whether the developing pubic ramus sees fit to separate off from the obturator trunk another single nerve the accessory obturator is not known to the surgeon when he makes his incision. However, if he is aware not only of the probabilities but also of the possibilities success is the more likely.

My own success with hip joint denervation has been gratifying and stimulated research into a joint of more complex supply, the knee. Students inaccurately, but proudly, remember the supply of this joint on account of the geniculates, two superior, two inferior and one in the middle.

The work of Gardner (1948) and my own dissections have shown that the branches to the knee are constant in name but vary in their level of origin from the parent nerve and the volume of their supply. Having ascertained this, it remained to work out a surgical technique to encompass the variations and this I consider has been done, at least for practical purposes.

The knee joint being a weight-bearing hinge is subjected to considerable strain throughout life. It is twisted, wrenched, kicked, knocked, knelt on and generally traumatized from infancy onwards and as a result becomes gnarled and nobbly at an earlier age than many other joints often at a time when the patient is otherwise physically active, earlier than the hip in which changes generally present in later life, this excluding the changes subsequent on major joint trauma in itself an increasing aetiological factor in all joint pathology.

So that a relatively young person according to life expectation standards becomes crippled or socially inactive as a result, with

little other than conservative and generally temporary relief to look forward to, arthrodesis of this joint is unphysiological and somewhat incommoding and generally there is little limitation of movement mechanically in this arthritic joint, apart from that of muscle spasm secondary to the pain factor.

If a permanently painless but still immovable joint can be produced by an operation involving no trauma to the joint itself and with little risk to the patient—here is the ideal. By the technique to be described, this seems possible as the operation is little more than subcutaneous, does not involve joint structures, can if necessary be done with local infiltration anaesthesia. An inadequate series as yet exists to confirm the first and most important feature, relief of pain, but vital trials have been gratifying and are here published at such an early stage for interest only, as review of the literature has failed to reveal any such procedure as yet attempted elsewhere.

The basis of the operation is essentially an anatomical study and cannot be attempted without first being familiar with the pattern and layout. Based on the dissections of Gardner confirmatory dissections showed the joint supply to be as follows:

(a) *Femoral branches*

- (1) *Saphenous*. From this nerve arises a branch sometimes in the femoral triangle descending with the femoral artery or just before the artery passes through the adductor magnus. In either case the branch descends vertically anterior to the tendon of the adductor magnus then turns towards the antero-medial aspect of the joint capsule extending as far as the ligamentum patellae. Two branches may be present, the anterior of the two is mainly cutaneous.
- (2) *Nerve to vastus medialis*. This descends along the medial edge of this muscle in company with the saphenous branch about half an inch posterior to it. The most distal of its branches turns around the edge of the muscle somewhat more superiorly than does the articular

branch of the saphenous. This nerve makes a graceful curve around the postero-medial border of the muscle under cover of the fascia of this muscle often anastomosing with the branch from the anterior obturator. Some branches may join the superior medial geniculate vessels anteriorly, others pass posteriorly across the adductor tubercle.

This and the saphenous branch are not to be confused with the cutaneous branches of the femoral.

(b) *Branches of the obturator*

- (1) *Anterior obturator.* This terminal branch of the nerve emerges under cover of the adductor magnus tendon about one and one-half inches from the tubercle. It may anastomose with the saphenous branch or the branch from the nerve to the vastus medialis.
- (2) *Posterior obturator.* The posterior division of the obturator nerve continues through the adductor magnus and reaches the popliteal fossa by descending along the popliteal

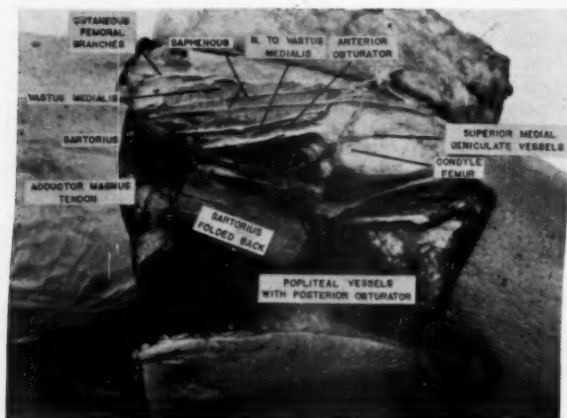


FIG. I

- (3) *Nerve to vastus intermedius.* This descends on the anterior surface of the femur to supply the periosteum as far as its articular cartilage and as such has little joint representation.
- (4) *Nerve to vastus lateralis.* This nerve follows the descending branch of the lateral femoral circumflex underneath the rectus femoris on the intermedius muscle. The most distal of a number of branches turns round the posterior edge of the muscle where it divides into a number of filaments which enter the anterior portion of the joint on the lateral side. This nerve may be absent, minimal or anastomose with the superior lateral geniculate arising from the peroneal.

vessels. Sometimes it forms a plexus around the vessels giving branches to them and to the superior medial geniculate vessels.

Direct continuation of it anastomoses with the tibial branches to form the popliteal plexus. It supplies the superior part of the posterior medial capsule. Its trunk can be recognized lying deep and medial to the vessels.

(c) *Sciatic branches*

- (1) *Tibial.* Generally a single large branch as in the cat but there may be two or three which may arise from the tibial portion of the sciatic descending with this great nerve and bound to it by connective tissue or may arise from the tibial in

the popliteal fossa itself. These branches form with the posterior obturator a dense plexus on the back of the joint capsule. Most branches from this plexus enter the capsule posteriorly the continuation becoming the inferior medial geniculate. Other branches of the plexus go to join the superior and inferior lateral geniculate vessels.

that in the cat and many other animals the supply is represented by the tibial and saphenous nerves.

TECHNIQUE OF OPERATION

An Esmarch's tourniquet is applied. Through a longitudinal incision about 4 inches long on the medial side of the joint covering the posterior edge of the vastus

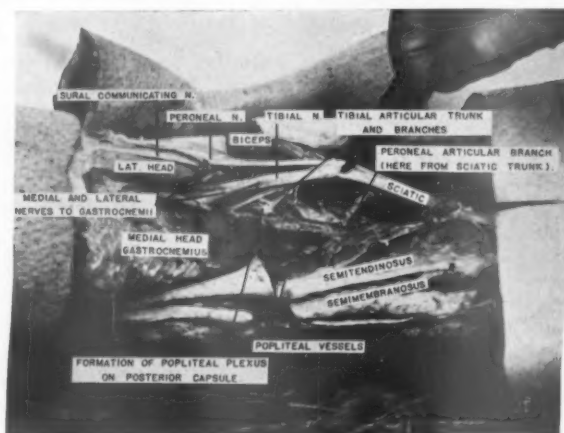


FIG. II

- (2) *Peroneal*. Like the tibial branches it may arise from this nerve or its sciatic component. It may be taken over by the nerve to the vastus lateralis and so be absent. Whatever the origin it joins either the superior or inferior lateral geniculate vessels, generally the superior where it passes laterally under cover of the biceps femoris tendon.
- (3) *Recurrent peroneal branch* arises outside the popliteal fossa and supplies only the tibiofibular joint and the periosteum of the tibia to the level of the capsular attachment.

This represents the constant pattern of the branches but the volume of supply may vary and some may be absent.

For practical purposes the nerve to the vastus intermedius and recurrent peroneal have little to do with the moving functional part of the joint. It is interesting to note

medialis centred on the adductor tubercle extending down to the fascia over this muscle. The saphenous branches is found under the deep fascia of the thigh and divided after ligation. The nerve to vastus medialis is found turning around the lower border of the muscle and the anterior obturator perforating the adductor magnus tendon.

By retracting the medialis forward and sartorius posteriorly the medial popliteal fossa is entered by blunt dissection and the vessels outlined. Here the posterior obturator can be found lying on the side of the vessel.

An incision laterally over the anterolateral thigh at the same level will reveal the nerve to vastus lateralis emerging from under rectus femoris tendon passing round the edge of the lateralis muscle.

The patient is then turned part over and an "S" incision covering the popliteal fossa in its length from biceps semimembranosus

junction to the confluence of the gastrocnemii. The popliteal deep fascia is incised with care as the nerves lie quite superficially in fatty tissue. The sciatic tibial and peroneal nerves are then isolated and all branches arising from the anterior or femoral surface are excised down to the branches to the medial and lateral heads of the gastrocnemius from the sciatic and tibial, and from the peroneal to where it leaves the fossa. The wounds are closed after covering these nerves adequately.

No post-operative restriction is applied regarding mobility consistent with normal wound healing and tension.

That this operation is a practical proposition has been demonstrated clinically on a woman who had extensive osteoarthritis of the knee joint with two large loose bodies, one lying in the intercondylar notch anteriorly, another in the suprapatellar pouch. For years this patient had had severe aching pains in the knee both by day and night with occasional let downs and lockings attributable to the loose bodies. There was marked muscle spasm and she had great difficulty getting round on account of the pain. From the type pain complained of there was no doubt that this was due to her arthritic condition. Denervation was performed as above combined with arthrotomy on the medial side with removal of two marble-sized loose bodies. Inspection of the joint showed the typical osteoarthritic pathology, hypertrophic vascular almost papilliferous synovia, osteoarthritic lipping of the edges of the bone vascular pannus and destruction of the articular cartilage some of which showed obvious fibrosis.

In the immediate post-operative period movement was possible as soon as the soreness from the skin wounds had eased, there was none of the usual severe pain associated

with arthrotomy. On the third day there was 90° of painless movement, the patient stated that the joint felt different and could not feel the arthritic crepitus previously noted in the joint, although this was still present.

Walking was delayed by the fact that a mid-tarsal fusion had been done as well for extensive localized arthritis of the talonavicular joint. As soon as a plaster was applied to the lower leg she stumped around on this without any discomfort.

The cynics of such procedures as denervation frequently quote Charcot's joints as the logical outcome. Experience with other joints shows that this does not occur, because the normal pain and proprioception to the limb as a whole is not interfered with, the coverings of the joint that is skin, muscle and subcutaneous tissue, retain normal innervation and so protective reflexes remain. Further experimental proof of this is in progress.

CONCLUSIONS

The denervation of the knee joint is a practical surgical proposition is demonstrated with the anatomical data referable to it, composed from actual dissections.

A recent case where this operation has been performed with success is cited to stimulate interest in this subject.

The ideal condition for performance of the operation is the osteoarthritic knee joint where other joints are free of the disease or symptomless as denervation can produce a painless but still mobile joint and it is hoped a grateful patient.

A second case similarly treated has produced equally gratifying results.

REFERENCE

GARDNER, E. (1948), *Anat. Rec.*, vol. 101, page 109.

A CASE OF CARCINOMA OF THE PANCREAS OBSTRUCTING BOTH THE CYSTIC DUCT AND THE COMMON HEPATIC DUCT

By J. L. CONNELL

St. Vincent's Hospital, Melbourne

THE case I am here reporting presents such unusual features to my mind that I think the death of the patient may truly be attributed to developmental misadventure.

M.N., aet. 68, was admitted to St. Vincent's Hospital on 27th August, 1954. She stated that for the past two days she had noticed jaundice. At no time had she abdominal pain but during the preceding six months had complained of loss of appetite, loss of a stone in weight and diarrhoea. She stated that she had lately opened her bowels 7-8 times a day and that the motions were pale and fluid. During the week prior to admission she had noticed that her urine was very dark.

Serum proteins were 5.3 gm. per cent. and the Albumin/globulin ratio was 1.8/1.

Alkaline phosphatase was 60 King-Armstrong units.

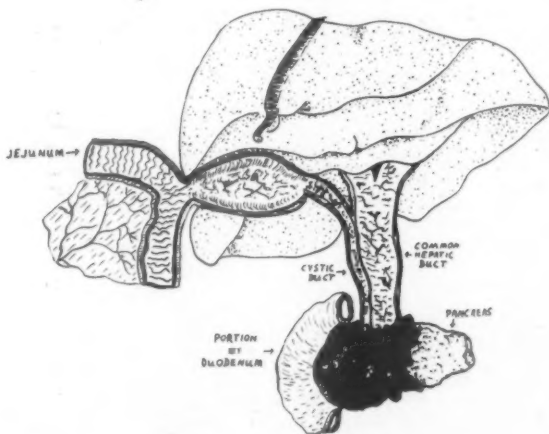
Prothrombin per cent. was 65.

The Cephalin Flocculation Test was partially "positive."

Blood Urea was 44 mg. per cent.

The Occult Blood Test on the faeces was positive.

A firm diagnosis of carcinoma of the ampulla of Vater was made and laparotomy was decided upon. The patient, however, stating that she felt well refused operation for two weeks. Finally she consented.



The drawing is a diagrammatic reproduction of the autopsy findings. The specimen itself is unfortunately not photogenic.

On examination she was a thin, elderly lady who was deeply jaundiced. The temperature and pulse rate were normal and her blood pressure was 170/85 mm. of mercury. No abnormality was found on examination of her chest. The abdomen revealed moderate gaseous distension and the gall-bladder was easily palpable beneath the right costal margin. There were no signs of intra-peritoneal free fluid. The liver and spleen were impalpable.

Special investigations included:

Urine examination which revealed the presence of bile pigments and bile salts but no urobilin.

Serum bilirubin was 12.3 mg. per cent.

After adequate vitamin K therapy the abdomen was opened through a right paramedian incision. The peritoneal cavity contained 1 to 2 pints of bile-stained fluid. Small carcinomatous deposits were found scattered over the peritoneum and there were several large plaques of carcinoma in the pouch of Douglas. The gall-bladder was grossly distended. The liver, although enlarged, did not reveal any evidence of secondary carcinoma. On palpation of the pancreas a large hard fixed mass was found to be replacing the head of the gland. An inoperable carcinoma of the head of the pancreas was diagnosed and it was decided to do a short-circuit operation.

The gall-bladder was aspirated (it contained dark green bile) and then a cholecysto-jejunostomy was performed using a simple loop of proximal jejunum.

Following the operation the jaundice instead of abating, in fact steadily became deeper. The serum bilirubin climbed progressively to 20.4 mg. per cent. It was decided that for some reason the cholecysto-jejunostomy was not functioning. Re-exploration was discussed but in view of the extensive spread of the disease and the poor condition of the patient it was decided against. The patient greatly deteriorated and died of liver failure and bronchopneumonia, three and a half weeks after operation.

At autopsy the abdomen contained three pints of deeply bile-stained fluid. Extensive peritoneal carcinomatous seeding was revealed. There was a large carcinoma of the head of the pancreas which had ulcerated into the duodenum. The gall-bladder was collapsed and the cholecysto-jejunostomy was quite patent, in fact a channel half an inch across existed between the two organs.

The common bile duct was enormously dilated as were the intra-hepatic biliary channels. They contained "white" bile. The cystic duct apparently joined the common hepatic duct to form the common bile duct about an inch below the porta hepatis. However, on close dissection it was found that the lumina of the two ducts did not communicate at this

point. In fact the cystic duct ran down within the wall of the common duct right to the pancreas. The two ducts maintained their independence until they both became lost within the carcinoma.

It then became obvious that the cholecysto-jejunostomy had done nothing to relieve the jaundice. It had merely released the tension in the gall-bladder. The fact that the gall-bladder at operation had contained bile pointed to the fact that the common hepatic duct had become obstructed before the cystic duct. One's suspicions would not have been aroused even if the gall-bladder had contained "white" bile at operation for this is a common finding with malignant obstruction of the extra-hepatic biliary channels. A more thorough exploration of the bile ducts at operation might have revealed the true state of affairs. However, I doubt this very much because the cystic duct apparently joined the common hepatic duct at the usual site, and it was only the meticulous dissection by Dr. Tait Smith at autopsy that revealed the independence of the two channels.

ACKNOWLEDGEMENTS

I wish to thank Mr. Kenneth Hadley for permission to report this case for it was under his direction that the patient was treated. I am also most grateful to Dr. A. Tait Smith for his help and advice.

Books Reviewed.

SPINAL EPIDURAL ANALGESIA.

By P. R. BROMAGE, M.B., B.S. (London), F.F.A.R.C.S., D.A. Edinburgh: E. and S. Livingstone Ltd., 1954. 8½" x 5½", vii plus 123 pp., 41 illustrations. Price: 15s. net.

This book is based upon the author's experience of 1,000 personal administrations over a period of five years. It deals almost entirely with the induction of epidural analgesia by the lumbar route. Caudal analgesia is deliberately excluded from the discussion and the thoracic approach is mentioned only to be condemned.

The early chapters deal with anatomy and physiology, and several pages are devoted to a discussion on the pressures that have been stated to exist in the epidural space. The author's conclusions on this matter are based on the evidence at present available.

The chapters on "Identification of Epidural Space" and "Drugs and Equipment" are essentially practical. Whilst various techniques are described, the disadvantages are explained and, finally, a careful description is given of the method which the author considers to be safest. The impression is left with the reader, however, that it is a technique that would be mastered only after a considerable experience, and could be dangerous in the hands of the tyro.

Chapter VII is entitled "The Blood Pressure" and deals, all too briefly, with the production of deliberate hypotension and with the correction of hypotension when it is not desirable. The use of pressor agents, notable ephedrine, methedrine and nor-adrenaline is recommended to combat unwanted fall of blood pressure. No mention is made of the bad effects on renal function that may follow the use of these agents under such circumstances.

Chapter VIII describes the technique of "Continuous Epidural Analgesia" using an in-dwelling plastic catheter. Here, once more, the method is given in detail from the personal experience of the author. Having read the final chapter on "Indications and Contra-indications" one is left in doubt as to the usefulness of the methods so carefully described in the earlier chapters.

The book is well published, the illustrations are well chosen and clear. Proof reading has been careful, the only error noted being the incorrect spelling of polyvinylpyrrolidone on page 71.

A point that is never mentioned throughout the book is the time involved in inducing spinal epidural analgesia and the incompatibility of the method with a busy surgical clinic.

ORAL AND DENTAL DISEASES.

By HUBERT H. STONES, M.D., M.D.S., F.D., S.R.C.S. Third Edition. Edinburgh, Scotland: E. and S. Livingstone Ltd., 1954. 9½" x 6½", xix plus 1019 pp., 959 illustrations. Price: £5 net.

This edition follows the same pattern as its predecessors; 460 new references have been added, making a total of 2,625. The black and white prints and coloured illustrations are essentially the same.

It was hoped that the standard of reproduction of X-ray films would be improved in this volume, but readers will be disappointed in this regard. Indeed this is one of the main causes for criticism of the publication.

In general, Professor Stones must be congratulated on the over-all high standard of the text.

ANESTHESIA IN GENERAL PRACTICE.

By Dr. S. C. CULLEN. Fourth Edition. Chicago, U.S.A.: Year Book Publishers Inc., 1954. 8" x 5½", 312 pp., 37 illustrations. Price: \$5.00.

A fourth edition in less than ten years speaks well for Dr. S. C. Cullen's "Anesthesia in General Practice."

In this small book (300 pages) the major problems concerned are briefly and clearly discussed. In the chapter on depressant drugs the author stresses the potential effect on respiration in this regard, of pethidine in usual therapeutic quantities and gives a very useful resume of the importance of morphine and scopolamine and their dosage ratio.

"Airway" and "Ventilation" are two chapter headings whose contents should be absorbed by those learning, and teaching, anaesthesia.

While the pharmacology of the muscle-relaxants is briefly but clearly described, technical details of therapy are exceedingly meagre and not very helpful. Spinal analgesia by comparison is dealt with in some detail. Colouring of solutions for sterilization of ampoules, is thought desirable, so that contamination, if present, may be easily visible. Current opinion in this country, however, considers autoclaving, or at least boiling in distilled water as far safer procedures. Minor sequelae, such as headaches, transient nerve palsies and loss of sphincter control are mentioned, though the statement that chemical meningitis is a rare complication conflicts with the experience of this reviewer. Paraplegia is not mentioned. While its exact causation may be a matter of doubt, it is an indisputable sequel of the technique whose admitted rarity cannot wholly banish the fear in some minds of the possibility of its occurrence.

The physio-pathological mechanisms of shock are well integrated and the basic disparity between circulating blood volume and vascular capacity as a common denominator is stressed. The statement that with adequate fluid replacement hypotension is due to some cause other than oligæmia, conflicts, however, with experience in irreversible shock where blood may be pooled in the large veins without sign of increased systolic pressure or improvement in the patient's condition.

The final chapter is a timely reminder on an easily-forgotten subject, explosion hazards. The almost complete local immunity from such disasters is certainly due in part to the clouds of steam and drops of moisture about which operating theatre habits commonly grumble.

The book is well produced on good paper and the illustrations are clear. It seems a pity that those in Figures 4 and 9 should have been transposed,

pharyngeal airways being read for laryngoscope blades and vice versa. Also the light-hearted cartoons showing reactions to cocaine and other drugs and the effects of oxygen lack, while exceedingly arresting, might seem to some readers more appropriate in a comic strip.

DIAGNOSIS OF ACUTE ABDOMINAL PAIN.

By W. REQUARTH. Chicago, U.S.A.: The Year Book Publishers Inc., 1953. 8" x 5½", 243 pp., 79 illustrations. Price: \$5.00.

This book of 235 pages gives a well-balanced and fairly complete review of the problem. Although numerous aids to diagnosis are described, the commonsense approach to the patient is illustrated by the statement "Physicians tend to place too much reliance on laboratory findings and to utilize them as a less bothersome road to correct diagnosis than their own eyes and ears."

It is good to see emphasis placed on the use of the stethoscope, a much neglected instrument in these cases; we support strongly the author's statement that "the changing character of peristaltic sounds in acute abdominal disease is perhaps one of the most valuable aids to diagnosis." He describes in detail the typical findings on auscultation in different acute abdominal diseases.

It is surprising to learn that "Measurements of abdominal wall rigidity with a tensiometer indicate that unilateral rigidity is a clinical illusion unless associated with a mass," and also that "red cells appear in the urine in almost 90 per cent. of cases of retrocaecal appendicitis."

Some disappointments are encountered. In discussing perforated peptic ulcer the author says "obliteration of liver dullness is an unreliable sign and appears also with tympanites"—surely this must be because he carries out the test in the dorsal position instead of in the classical left lateral. It is curious to find that spontaneous rupture of the oesophagus is not even mentioned, although it is becoming so well known as a subtle impersonator in upper abdominal diagnosis.

The arrangement of the book is sensible, with separate chapters devoted to diseases for which immediate operation is imperative, those for which operation can be delayed, and those for which operation is harmful.

The practical nature of this volume is indicated in the foreword by Warren Cole—"it is much more essential to make the correct decision as to whether or not operation is indicated than it is to make the correct diagnosis."

This book can be strongly recommended for students, and those working for post-graduate degrees.

LECTURES ON GENERAL PATHOLOGY.

Edited by SIR HOWARD FLOREY, M.D., F.R.C.P., F.R.S. Melbourne University Press, 1954. 9½" x 6½", xii plus 733 pp., 344 illustrations. Price: 84s.

This volume is a compilation of lectures delivered in the Department of Pathology of the University of Oxford to students who are spending one year

studying for an Honour School. These have been given by ten lecturers and include such as G. R. Cameron and A. H. T. Robb Smith.

In the 37 chapters, a large amount of pathology is covered, particular attention having been given to inflammation and the general problems of immunity and conditions related to it.

Each chapter contains a large amount of information which will be of interest to all those dealing with and teaching these subjects. There is throughout the work a live atmosphere—it is obviously a study of living processes—which will commend itself to most readers. At the same time it must be appreciated that the scope of the various subjects is necessarily limited so that a complete statement on any subject should not be expected. Nevertheless, the information covers a wide field and much of it is such as is difficult to obtain elsewhere; this makes the presentation extremely valuable.

For the reasons mentioned the volume cannot be recommended as a textbook, particularly to junior students. Very many parts of the subject have not been dealt with and, for example, tumours are scarcely mentioned. This is not meant as criticism but rather to indicate the scope of the book. Indeed, this very point is mentioned in the preface.

On the other hand, as an adjunct to one of the textbooks of pathology, this volume will be found of extreme value and, indeed, should be perused by all students of pathology.

The book is well produced with clear type. The illustrations in general are well chosen and are excellently reproduced; the numbering of these in their own chapters independently of the rest of the book is, however, a distinct disadvantage. There is an adequate index including an index of authors to whom reference is made.

CLEFT PALATE AND SPEECH.

By MURIEL E. MORLEY, B.Sc., F.C.S.T. Third Edition. Edinburgh: E. and S. Livingstone Ltd., 1954. 7½" x 4½", xx plus 173 pp., 64 illustrations. Price: 17/6 net.

There has been no major change in this latest edition of Miss Morley's book. This work, since it was first published, has become not only a classic textbook for use in training speech therapists but a most valuable stand-by for surgeons who are concerned closely with the surgery of cleft palate and who need to know something at least of the language used and the methods employed by the speech therapists who follow up their cases. It is most important that surgeons and speech therapists meet on common ground to discuss and plan the treatment of these children and this book provides an excellent background for such meetings and discussion. Certain minor rearrangements in classifications of treatment and a few changes in emphasis, together with a new illustrated section devoted to pharyngoplasty have been introduced, but it says much for the work that it has needed so little alteration to bring it up to date. It can still be regarded as a most useful and practical publication.

MODERN TRENDS IN DISEASES OF THE EAR, NOSE AND THROAT.

By MAXWELL ELLIS. London: Butterworth and Co. Ltd., 1954. 9½" x 6½", ix plus 471 pp., 140 illustrations. Price: £4 10s. sterling.

This is a most stimulating and interesting book and no practising ear, nose and throat surgeon can afford its absence from his bookshelf. He will derive an immense amount of new information from its pages: he will find a good many of his own hunches and ideas confirmed and he may strongly disagree with a good many statements and, therefore, be forced to reconsider the foundations of his own beliefs.

Josephine Collier's article is an excellent review of the problems facing the surgeon when he has to deal with a seventh nerve paralysis.

Stirk Adams' review of upper respiratory tract infection in childhood is full of meat but simple endonasal antrotomy is not adequately considered nor is there any discussion of the prolonged prophylactic use of the sulpha drugs in the treatment of the condition. Few surgeons in this country would contemplate a radical Calwall-Luc operation on a young child until these alternatives had at least been tried. To this reviewer the use of in-dwelling antral tubes is anathema; they achieve nothing that a well made endonasal antrotomy will not achieve and they provoke a marked tissue reaction that may be very difficult to deal with.

Otty's article on the excision of pharyngeal diverticulum is adequate but he makes no mention of the difficulty the tyro will experience in passing an oesophagoscope into the lumen of the oesophagus: nor does he mention how much easier the fundus of the diverticulum is to find if a small pack is placed in it.

Little's article on hearing aids cannot fail to interest all otologists and the same is true of what Professor Ewing has to say on the education of deaf children.

Distinctions are invidious; those for whom this book has been written will be extremely grateful for the very great services rendered to them by the panel of authors and above all to the general editor for his vision and discrimination.

HISTORICAL REVIEW OF BRITISH OBSTETRICS AND GYNAECOLOGY, 1800-1950.

By J. M. MUNRO KERR, R. W. JOHNSTONE, and MILES H. PHILLIPS. Edinburgh: E. and S. Livingstone Ltd., 1954. 9½" x 7½", viii plus 420 pp., Price: 30s. net.

This book is a sequel to H. R. Spencer's "History of British Midwifery 1650-1800," and has been written by a group of Senior Fellows of the Royal College of Obstetricians and Gynaecologists and presented to the College on the occasion of its Silver Jubilee. It places on record the contribution of British Medicine to the field of Obstetrics and Gynaecology during 150 years which saw the introduction of anaesthesia, bacteriology and the antibiotics to surgical practice.

The major portion of this work is devoted to obstetrics, being divided into three 50-year surveys, and a group of articles on special subjects. Credit

is given to T. G. Wilson of Adelaide for organizing the first out-patient ante-natal clinic and to J. C. Windeyer of Sydney who was not far behind. More recently the work of Dixon Hughes in Sydney and Dawson in Dunedin on the prevention of eclampsia receives due recognition.

The gynaecological section of the book traces the development of gynaecology as a surgical specialty. The names of such pioneers as Charles Clay, Spencer Wells, Lawson Tait, Bland Sutton and Victor Bonney are familiar to all surgeons.

This book will prove of great interest to all who practice obstetrics and gynaecology and in particular should be read by all teachers of this specialty.

The publishers are generously donating all profits from the sale of this book to the Jubilee Building Appeal of the Royal College of Obstetricians and Gynaecologists.

BASIC ANATOMY.

By G. A. G. MITCHELL, O.B.E., T.D., M.B., Ch.M., D.Sc., and E. L. PATTERSON, M.D., Ch.B., B.Sc. Edinburgh: E. and S. Livingstone Ltd., 1954. 9½" x 6½", viii plus 438 pp., 286 illustrations. Price: 45s. net.

This is an introductory text book, and as such is, in its short space, relatively comprehensive and completely readable. The volume commences with an excellent historical review, of which one can only regret the brevity; more would be fascinating.

There follows a section on basic descriptive terms and data about types of anatomical study, e.g., systematic, surface, applied, microscopic, comparative and anthropological. The animal kingdom is classified. Embryology is given only 15 pages and is followed by a small histology section. Various wry statements appear, such as "the mammary glands are well developed in the female," but this is compensated by various aides-memoire such as Hilton's Law "the nerve supply of a joint, the muscles moving it and the skin over the muscle insertion is from the same source." It seems anomalous to have a discussion of the palate and vomer bones in a book of this size. Comparative anatomy and developmental basis as seen in the vertebral column, the carpus and the tarsus are good, but it is hard to reconcile the amount of data on the nervous system where even blood supply of nerves and the pelvic autonomic plexuses appear, with the fact that there are twelve lines only on the small intestine and yet forty-eight lines on the enteric plexuses with eight diagrams. There is an excellent glossary.

Summarized, this book is a very good one, but is too detailed for an introductory book in some respects and in other respects too incomplete for any detailed study.

MANUAL OF PROCTOLOGY.

By EMIL GRANET, M.D. Chicago, U.S.A.: Year Book Publishers, 1954. 8" x 5½", 345 pp., 119 illustrations. Price: \$7.50.

This small book, by a United States surgeon, is an excellent summary of modern proctological practice. It is well illustrated and concisely written. The book also serves to demonstrate the remarkable influence exerted by St. Mark's Hospital, London, on the practice of proctology generally.

It is perhaps unfair to criticize parts of the book in which orthodox treatment is recommended, but it is regrettable that those who specialize in diseases of this region are not able to improve upon techniques established centuries ago. This is not intended as a criticism, but as a reflection after reading the book.

This book can be strongly recommended, and the Year Book Publishers are to be congratulated on the high standard of their work.

SURGERY OF THE CAECUM AND COLON.

By STANLEY AYLETT, M.B.E., M.B., B.S., B.Sc., F.R.C.S. London: E. and S. Livingstone Ltd., 1954. 9½" x 6½", vii plus 295 pp., 142 illustrations. Price: 45s. net.

Mr. Aylett will earn the gratitude of a succession of surgeons for the exposition of the principles and details of treatment made so clearly and logically. Full of interest and help to the surgeon of experience, this monograph will be a continuing boon to the young surgeon, making clear the answer to those many problems which beset him, answers which are not usually afforded except under an exceptionally fortunate and long apprenticeship.

Those valuable chapters on cancer of the colon leave little to be desired and are a model of clarity. The problem of haemorrhage of obscure origin is discussed in a most helpful way. Of the method described for the performance of low anastomosis of the colon to a short ano-rectal stump careful experience is needed and it is not without pitfalls as is

perhaps hinted by the advocacy of temporary transverse colostomy at the time of operation. It is rightly noted that drainage must be made of the surrounding space about any anastomosis to that part of the rectum not completely covered by peritoneum.

Those sections which deal with the problems of ulcerative colitis are stimulating but lack the concise lucidity of other chapters, perhaps because of the very nature of the subject. An authoritative exposition, based on the experience of all who have written wisely and on the author's judgment, makes it necessary that Mr. Aylett should tread more dangerously in giving help to younger men.

Books Received.

CHILDBIRTH WITHOUT FEAR.

By GRANTLEY DICK READ, M.A., M.D. (Cantab.). Third Edition. London: William Heinemann, 1954. 8½" x 5½", xii plus 243 pp., Price: 17/6 net.

THE FOUNDATIONS OF SURGERY.

By GEORGE PERKINS, M.C., M.Ch., F.R.C.S. Edinburgh: E. and S. Livingstone Ltd., 1954. 7½" x 4½", viii plus 236 pp. Price: 10s. net.

DEMONSTRATIONS OF OPERATIVE SURGERY.

By HAMILTON BAILEY, F.R.C.S., F.A.C.S., F.I.C.S., F.R.S.E. Second Edition. Edinburgh: E. and S. Livingstone Ltd., 1954. 8½" x 5½", xii plus 387 pp., 538 illustrations. Price 24s. net.

INDEX

A	Page	Page
Abdominal total gastrectomy for oesophago-duodenostomy	295	
Acute phlegmonous caecitis	279	
Adenocarcinoma, papillary, of thyroid	1	
Agenesis, renal	137	
ALLDRED, A. J., Dupuytren's contracture	66	
Ampullary carcinoma, radical pancreato-duodenectomy for	106	
Antroduodenectomy and X-ray irradiation of duodenal ulcer	260	
— — — — — for duodenal ulcer, radiological findings in	268	
Anuria caused by blood-clot obstruction of solitary ureter	76	
Arrest, cardiac	81	
B		
Bile, extravasation of	181	
BIRRELL, J. H. W., The jugular body and its tumour	195	
Blood-clot obstruction of a solitary ureter	76	
Blood supply of the thyroid gland	303	
Bone formation in fibroadenomata	151	
Books Received	80, 160, 320	
Books Reviewed (Authors)		
Aylett, Stanley, Surgery of the caecum and colon	320	
Bromage, P. R., Spinal epidural analgesia	317	
Brooke, Bryan N., Ulcerative colitis	78	
Cullen, S. C., Anaesthesia in general practice	317	
Donovan, G. E., Medical electronics	78	
Edwards, J., Recent advances in surgery	240	
Ellis, Maxwell, Modern trends in diseases of the ear, nose and throat	319	
Flocks, R. H. and Culp, David, Surgical urology	240	
Florey, Sir Howard, Lectures on general pathology	318	
Grant, Emil, Manual of proctology	319	
Hetzel, Peter S., Studies in fluid balance	158	
Illingworth, C. F. W., Peptic ulcer	157	
Jaramillo-Arango, J., The British contribution to medicine		79
Kerr, J. M. Munro, Johnston, R. W. and Phillips, Miles H., Historical review of British obstetrics and gynaecology, 1800-1950		319
Lee, J. Alfred, A synopsis of anaesthesia		80
Levitt, T., The thyroid		79
Loewenthal, L. J. A., The eczemas—a symposium by ten authors		159
McKenzie, William, Ear, nose and throat diseases		159
Mitchell, G. A. G. and Patterson, E. L., Basic anatomy		319
Morley, Muriel E., Cleft palate and speech		318
Nissen, K. I., Resection-reconstruction of the hip		160
Osborn, G. R., Applied cytology		79
Requarth, W., Diagnosis of acute abdominal pain		318
Riches, E. W., Modern trends in urology		78
Rowbotham, G. F. and Hammersley, D. P., Pictorial introduction to neurological surgery		80
Scott-Brown, W. G., Methods of examination in ear, nose and throat		159
Sorsby, Arnold, Clinical genetics		157
Stewart, C. P. and Dunlop, D. M., Clinical chemistry in practical medicine		239
Stones, Hubert H., Oral and dental diseases		317
Winsbury-White, H. P., Stone in the urinary tract		159
Woodruff, Michel F. A., Surgery for dental students		239
Books Reviewed (Titles)		
Anaesthesia in general practice (Cullen, S. C.)		317
Applied cytology (Osborn, G. R.)		79
Basic anatomy (Mitchell, G. A. G. and Patterson, E. L.)		319
British contribution to medicine (Jaramillo-Arango, J.)		79
Cleft palate and speech (Morley, Muriel E.)		318
Clinical chemistry in practical medicine (Stewart, C. P. and Dunlop, D. M.)		239

F	Page	I	Page
FARRAR, J. F., joint author, see MACMAHON, J. S.		Inflammatory cysts of the breast — — — — —	70
Fibroadenomata of breast, cartilage and bone formation in — — — — —	151	Intervertebral disc, follow-up of cases — — — — —	63
FITZPATRICK, S. C., Sedimentation of hydatid scolices — — — — —	109	J	
FLEMING, J. P., joint author, Cancer of breast in Sydney teaching hospitals — — — — —	251	JAMIESON, K. G., Extradural haematoma in a haemophilic child — — — — —	56
FLEMING, W. B., Cartilage and bone formation in fibroadenomata of the breast — — — — —	151	— — — — — Mechanism of primary oculomotor nerve injury — — — — —	236
FREIDIN, J., Lateral spread of carcinoma of rectum — — — — —	283	JOHNSON, N., Anuria caused by blood-clot obstruction of a solitary ureter — — — — —	76
G		— — — — — Blood supply of thyroid gland — — — — —	303
Gastrectomy, abdominal total, with oesophago-duodenostomy — — — — —	295	— — — — — Traumatic rupture of the spleen — — — — —	112
Goitre, posterior mediastinal — — — — —	241	JOSKE, R. A., joint author, see STEPHENS, F. D.	
Gumma of the lung — — — — —	231	Jugular body and its tumour — — — — —	195
H		K	
Haematoma, extradural in haemophilic child — — — — —	56	KING, E. S. J., Metaplasia in the tunica vaginalis testis — — — — —	131
Haemophilic child, extradural haematoma in — — — — —	56	Knee joint, denervation of — — — — —	310
Hepatic duct, common, obstruction of and cystic duct — — — — —	315	L	
Hernia, oesophageal hiatus — — — — —	18	Lateral spread of carcinoma of rectum — — — — —	283
Hiatus hernia — — — — —	18	LEARMONTH, Sir James, On making inaugural orations — — — — —	172
HICKS, J. D., Inflammatory cysts of the breast — — — — —	70	LEITCH, O. W., Denervation of knee joint — — — — —	310
HORNE, T. W., Acute phlegmonous caecitis — — — — —	279	Lung, gumma of — — — — —	231
Hospitals, Sydney teaching, cancer of breast in — — — — —	251	M	
HOTTEN, W. I. T., joint author, see MACMAHON, J. S.		MACMAHON, J. S., HOTTEN, W. I. T. and FARRAR, J. F., Cardiac arrest — — — — —	81
HOWARD, R., joint author, see WEBSTER, R.		McKENZIE, G., Extravasation of bile after operations on the biliary tract — — — — —	181
HOWDEN, P. F., Gumma of the lung — — — — —	231	Mechanism of primary oculomotor nerve injury — — — — —	236
HUGHES, E. S. R., joint author, Abdominal total gastrectomy with oesophago-duodenostomy — — — — —	295	Mediastinal goitre, posterior — — — — —	241
HURLEY, J. V., Calcified epithelioma of Malherbe — — — — —	207	Megaureter with vesico-ureteric reflux in twins — — — — —	192
— — — — — Rhabdomyosarcoma of skeletal muscle — — — — —	45	Metaplasia in the tunica vaginalis testis — — — — —	131
Hydatid disease, cerebral — — — — —	161	MILLER, D., Follow-up study of 264 cases of intervertebral disc lesion treated surgically — — — — —	63
— — — — — scolices, sedimentation of — — — — —	109	MORRIS, Kenneth N., Posterior mediastinal goitre — — — — —	241
Hypertension, portal, rational treatment of — — — — —	98	Muscle, rhabdomyosarcoma of skeletal — — — — —	45
		N	
		NANSON, E. M., The present rational treatment of portal hypertension — — — — —	98

	Page		Page
NEERHUT, K. J., Renal agenesis and unicornuate uterus	137	SHARP, A., joint author, Cancer of breast in Sydney teaching hospitals	251
O		SIMMONS, R. T., joint author, see STEPHENS, F. D.	
Oculomotor nerve injury, mechanism of	236	SPENCE, J. W., joint author, Cancer of breast in Sydney teaching hospitals	251
Oesophago-duodenostomy after total abdominal gastrectomy	295	Spleen, traumatic rupture of	112
Oesophageal hiatus hernia	18	STEPHENS, F. D., JOSKE, R. A. and SIMMONS, R. T., Megaureter with vesico-ureteric reflux in twins	192
Orations, on making inaugural	172	Sydney teaching hospitals, cancer of breast in	251
P		SYME, George Adlington Oration	172
Palatal and lip defects, restoration of	144	T	
Pancreas, carcinoma of, obstructing cystic and hepatic ducts	315	Testis, tunica vaginalis, metaplasia in	131
Pancreato-duodenectomy for ampullary carcinoma	106	Thrombophlebitis, unusual case of	149
Papillary adenocarcinoma of the thyroid	1	Thyroid gland, blood supply of	303
PARSONS, P. J., joint author, Abdominal total gastrectomy with oesophago-duodenostomy	295	— — — — — see Goitre	
PICKERILL, H. P., Restoration of palatal and lip defects	144	— — — — — papillary adenocarcinoma of	1
Portal hypertension, rational treatment of	98	Traumatic rupture of the spleen	112
Posterior mediastinal goitre	241	Trephine biopsy in tumour diagnosis	217
Prostate, malignant, rectal manifestations of	272	Tumour diagnosis, trephine biopsy in	217
PULLEN, W. J., joint author, Cancer of breast in Sydney teaching hospitals	251	— — — — — of the jugular body	195
R		U	
Radiological findings in antroduodenectomy for duodenal ulcer	268	Ureter, solitary, blood-clot obstruction of	76
REAY, E. R., joint author, Rectal manifestations of the malignant prostate	272	Uterus, unicornuate and renal agenesis	137
Rectal manifestations of the malignant prostate	272	UTLEY, W. L. F., joint author, see REAY, E. R.	
Rectum, lateral spread of carcinoma of	283	V	
Renal agenesis and unicornuate uterus	136	VAN DEN BRENK, H. A. S., Trephine biopsy in tumour diagnosis	217
Resection of colon for diverticulitis	36	Venogram, new type of	149
Rhabdomyosarcoma of skeletal muscle	45	Vesico-ureteric reflux in megaureter	192
ROBB, D., Oesophageal hiatus hernia	18	Volvulus of the caecum	125
ROSE, T. F., Volvulus of the caecum	125	W	
ROYAL AUSTRALASIAN COLLEGE OF SURGEONS, George Adlington Syme Oration	172	Walking caliper, new	147
S		WEBSTER, R. and HOWARD, R., Papillary adenocarcinoma of the thyroid	1
Scolices, hydatid sedimentation of	109	WILLIAMS, P., A new walking caliper	127
Sedimentation of hydatid scolices	109	WILSON, E., Colonic resection for diverticulitis	36
		WOOD, I. J., joint author, Antroduodenectomy and X-ray irradiation in duodenal ulcer	260
		WOODRUFF, M. F. A., Unusual case of thrombophlebitis and a new type of venogram	149

ge
61

1
2

2
1
2

1
9
3

1
2
7
7
5

5
7

7
9
2
5

7
1
A
5

7
1